

160
4
U.S.
12
TM
1943

TM 9-221

LOS
U.S. Dept. of Army
WAR DEPARTMENT

TECHNICAL MANUAL



ANTI-AIRCRAFT MACHINE
GUN TRAINER M9

19 JUNE 1943



ANTIAIRCRAFT MACHINE GUN TRAINER M9

**Prepared under the direction of the
Chief of Ordnance**

CONTENTS

	Paragraphs	Pages
SECTION		
I. Introduction	1- 2	2
II. General description	3- 5	3
III. Installation and Preparation for use	6- 7	4- 27
IV. Operation	8- 9	28- 33
V. Description of major components	10-14	34- 67
VI. Adjustments	15-19	68- 73
VII. Care and preservation	20-23	74- 81
VIII. Trouble shooting	24-29	82-101
IX. References	30-31	102
INDEX		103-104

*Supersedes TM 9-221, dated 5 February 1943.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section I

INTRODUCTION

	Paragraph
Purpose	1
Scope	2

1. PURPOSE.

a. This manual is intended to give information and guidance to the personnel of using arms charged with the operation and care of the materiel.

2. SCOPE.

a. This Technical Manual covers the principles of operation of the Antiaircraft Machine Gun Trainer M9, and gives a detailed description of its parts and instructions for its operation, care, and routine maintenance.

b. Disassembly, assembly, and such repairs as may be handled by using arm personnel may be undertaken only under the supervision of an officer or the chief mechanic.

c. In all cases where the nature of the repair, modification, or adjustment is beyond the scope or facilities of the unit, the responsible ordnance service should be informed so that trained personnel with suitable tools and equipment may be provided, or proper instructions issued.

TECHNICAL MANUAL

ANTIAIRCRAFT MACHINE GUN TRAINER M9

CHANGES }
No. 1 }

WAR DEPARTMENT,
WASHINGTON 25, D. C., 18 October 1944.

TM 9-221, 19 June 1943, is changed as follows:

6. INSTALLATION.

a. Indoor Installation.

* * * * *

(22) NIGHT OPERATION.

* * * * *

(c) The plane for * * * on their course.

CAUTION: The rays produced * * * with a protective screen.
ALL STUDENTS AND OPERATORS MUST WEAR PROTECTIVE GOGGLES HAVING CLEAR GLASS LENSES AND LEATHER SIDE BLINDERS. THE GOGGLES MUST BE WORN TO PREVENT STRAY LIGHT FROM THE ULTRA-VIOLET LAMP CAUSING DISCOMFORT TO THE EYES.

7. PREPARATION FOR USE.

* * * * *

h. (Added.) Before proceeding with the trial of the equipment, the battle sound should be checked. It is desirable to become familiar with the procedure involved in operating the reproducing equipment for providing the battle sound. The single record player has a repeating mechanism for providing continuous battle sound if desired. Lift the center stud of the repeater assembly (fig. 16.1) from the turntable spindle and place it to one side. Place a record on the turntable and replace the stud on the spindle. Figures 16.1 and 17.1 show the record player with and without a record on the turntable. The record player is now ready for operation.

Check the operation of the record player by snapping the record player switch "ON". With the power cord connected to a receptacle, and the main switch on the control panel "ON", the turntable should revolve. Place the tone arm on the record so that the needle contacts the first sound groove. The tone arm should be carried across the record until it strikes the repeater bracket and trip lever. The tone arm will be carried upward on the repeater mechanism and then slide down to the first groove of the record to replay the record. If it fails to do so, see section VI for instructions.

*This change supersedes TB 9-221-1, 8 March 1944.

7574500

8. TRIAL OPERATION.

* * * * *

f. (Superseded.) To be sure complete equipment is operating correctly, repeat instructions in preceding subparagraphs, utilizing the battle sound. It is often desirable to leave the record turntable running, with the record in place. The battle sound may then be cut in and out of the system as desired, without the delay encountered in starting up the turntable. All of the sound effects have been set to be focused on the gun pointer and hence will not be as effective to anyone standing alongside the equipment.

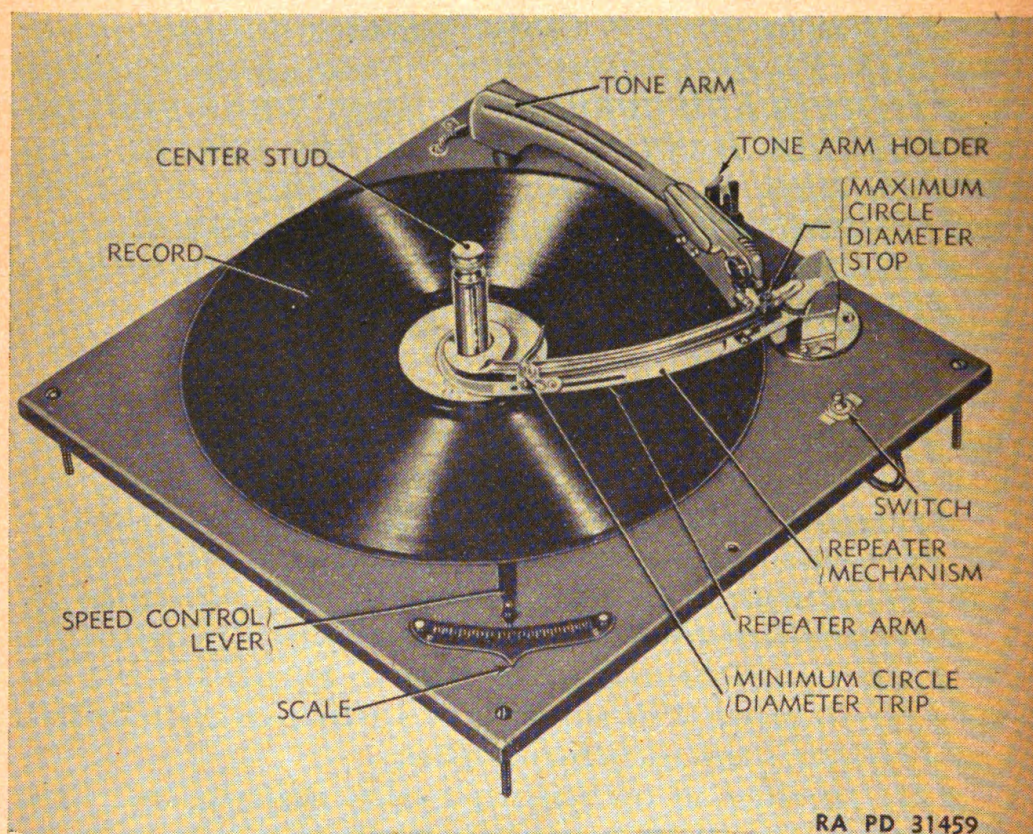


Figure 16.1.—Record Player—Record in Playing Position

(1) SINGLE RECORD PLAYER. To produce battle sound, place a record (fig. 16.1) on the turntable with the main switch on the control turned to "ON", snap the record player switch to "ON" to start the turntable revolving. Remove the tone arm from its holder and place the tone arm so that the needle contacts the first sound groove in the record. Snap the battle sound switch "ON". The speed control lever

should be set so the pointer is midway between the "F" and "S" positions on the scale. When changing records, or whenever desired, the tone arm may be lifted up where a catch will hold it in an inclined position (fig. 17.1).

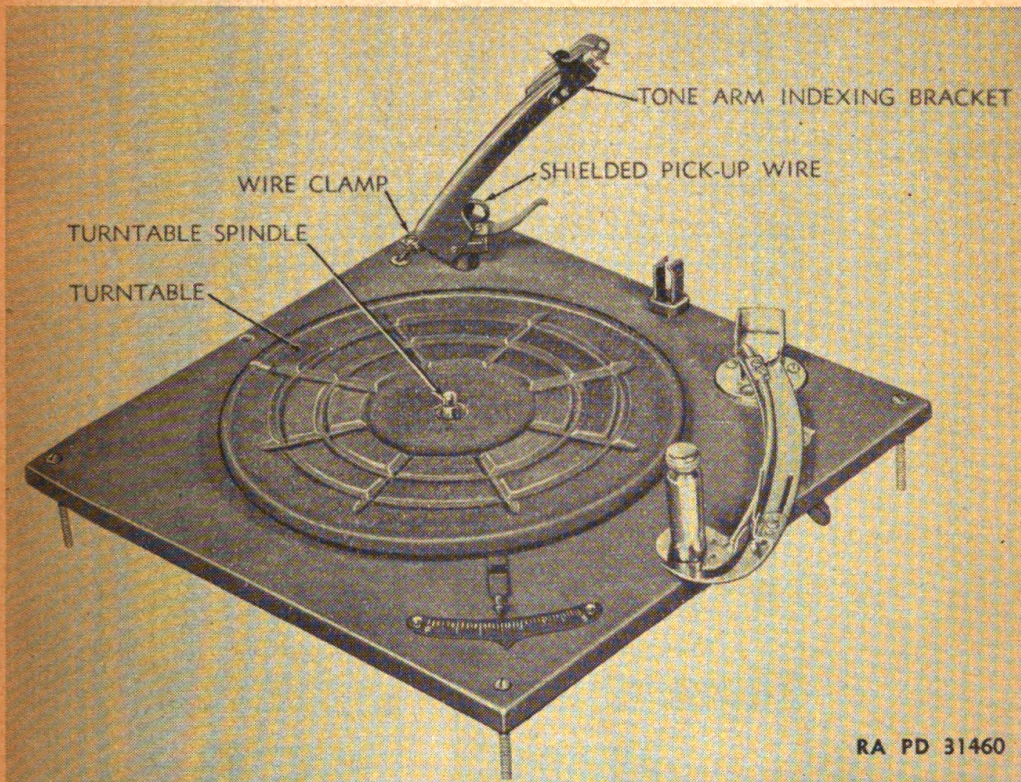


Figure 17.1.—Record Player—Top View

(2) **RECORD CHANGER.** To produce the battle sound, place the record on the turntable. With the main switch on the control cabinet turned to "ON" position, move the switch control knob to "REJECT" (figs. 15 and 16); then snap the battle sound switch to the "ON" position.

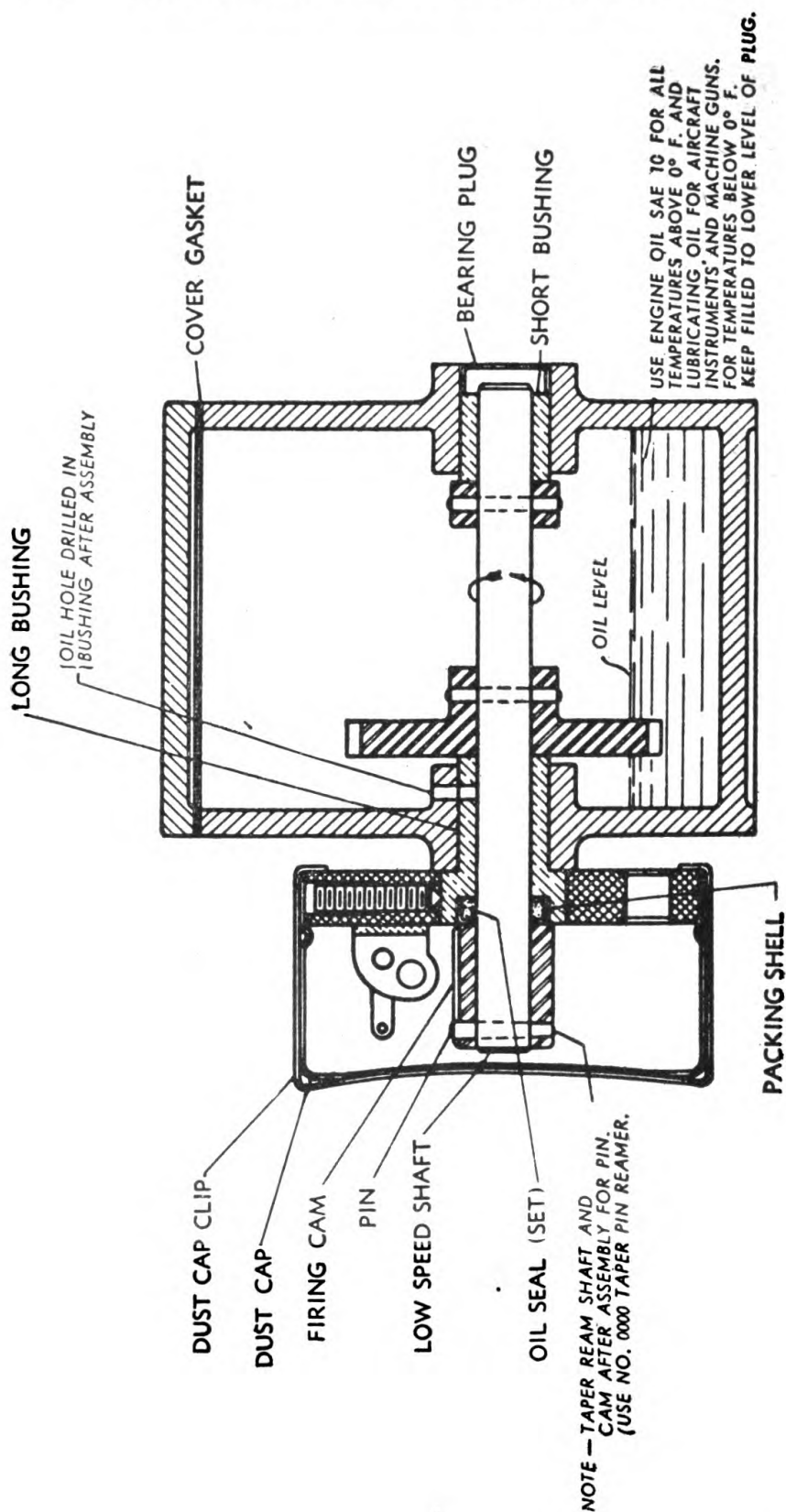
CAUTION: Always have switch control knob in manual position when the tone arm is moved manually. Failure to do this will injure the tone arm mechanism.

10. CONTROL AND SOUND EQUIPMENT.

* * * * *

i. The timing device * * * a spring clip (fig. 23).

CAUTION (Added): Use of heavy oil in breaker transmission (fig. 22) will result in burned-out timer motors. Keep transmission case



RA PD 60379

Figure 23.—Section Through Breaker Transmission

filled to lower level of plug (fig. 23), using engine oil SAE 10, for temperatures above 0° F.; lubricating oil for aircraft instruments and machine guns for temperatures below 0° F. When encountered, unauthorized heavy oil should be drained and replaced with the prescribed oil.

* * * * *

n. The muzzle blast * * * front of the cabinet. A lamp ballast and resistor is connected to the voice coil of the speaker to provide protection against excessive peak loads existing when the power supply has not warmed up sufficiently to operate efficiently. An auditorium-type speaker * * * the gun sound.

o. (Added.) Figures 16.1 and 17.1 show the record player with and without a record on the turntable. A record can be placed on the turntable when the repeater assembly is lifted to one side and the tone arm is either locked in its holder or raised to its locked position as shown in figure 17.1. The record player has a repeater assembly for replaying a record continuously, thus providing battle sound as desired. A speed governor is provided so that the speed rotation of the turntable may be varied from 65 to 88 rpm by changing the speed control lever from the "S" to "F" position on the scale. Normally the lever remains midway between "F" and "S". The record player can be used for playing standard records as well as the special sound records.

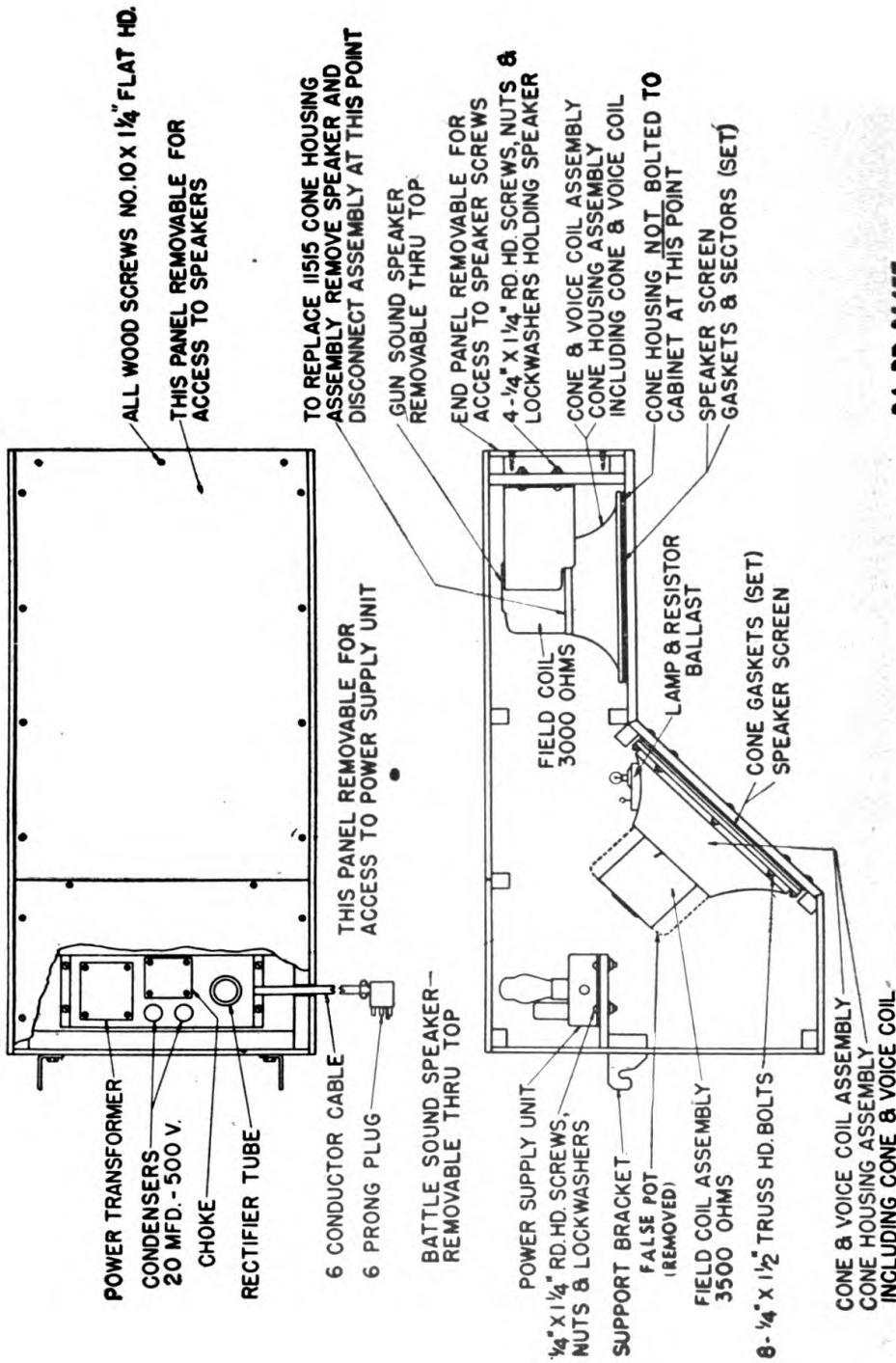
15. SOUND UNIT.

* * * * *

g. (Added.) Additional adjustments on the reproducing equipment involve the speed of the turntable, the minimum circle diameter trip, and the maximum circle diameter stop.

h. (Added.) The turntable (fig. 17.1) is normally set to operate at 78 revolutions per minute with the speed control lever (fig. 16.1) midway between the "F" and "S" settings on the scale. Variations in the speed of the turntable may be obtained by shifting the speed control lever toward the "F" or "S" setting on the scale depending upon whether the operator wants it run faster or slower.

i. The maximum circle diameter stop (fig. 16.1) directs the needle in the tone arm to the correct starting position to play or replay a record. With a record on the turntable, place the tone arm needle in the first sound groove near the outer periphery of the record. Loosen the setscrew in the stop (fig. 16.1) and slide the stop on the repeater arm until its projection contacts the roller on the tone arm indexing



RA PD 31457

Figure 27.—Speaker Cabinet with Side Removed and Top Broken away

bracket. Tighten the setscrew. A final adjustment can be made after a trial operation.

j. (Added.) The minimum circle diameter trip (fig. 16.1) is a combination sliding bracket and trip lever. With a record on the turntable, place the tone arm needle approximately $\frac{1}{4}$ inch from the last sound groove near the inner diameter of the record. Loosen the setscrew in the trip and slide it in its groove in the repeater arm until it contacts the finger on the tone arm indexing bracket (fig. 17.1). The end of the trip lever should contact the finger from the left side when viewed from the front of the record player. Tighten the setscrew. The final adjustment can be made after a trial operation. The trip lever must be so adjusted that the tone arm indexing bracket presses it backward sufficiently to raise the repeater arm (fig. 16.1).

20. LUBRICATION.

a. Sound Equipment.

* * * * *

(5) (Added.) Weekly add one to two drops of oil to the side of the turntable shaft (fig. 49.1) below the rubber washer so that it will run into the bearing. **DO NOT ALLOW OIL TO GET ON RUBBER WASHER.** Every 300 hours of operation or every 3 months, add two to three drops of oil in the oilholes on top of the gear case, and the governor. Add two or three drops of oil to the motor bearings and to the governor felt. See figures 49.1 and 52.1 for location of oiling points. Use engine oil SAE 10.

b. Gun. It is necessary to lubricate oil points in the gun daily with preservative lubricating oil (special). Of course, where * * * with a cloth.

* * * * *

21. CLEANING.

* * * * *

c. Air Compressor.

* * * * *

(2) The lubricating oil in the crankcase of the compressor should be changed at least every 6 months.

* * * * *

24. TROUBLE SHOOTING AND REMEDIAL MEASURES.

* * * * *

b. Sound Equipment.

Possible Cause
* * *

Possible Remedy
* * *

Poor adjustment of gun sound cam on timer
cam on timer. Adjust gun sound cam on timer
(par. 25m).

Record player fails to operate. Check power source and circuit
continuity through switch and
motor (par. 25n).

Record changer repeater fails to operate. Incorrect adjustment of maxi-
mum circle diameter stop or
minimum circle diameter trip
(par. 15 i or j).

Record changer speed control fails to operate. Loose connection on lever arm
(par. 25e).

* * * * *

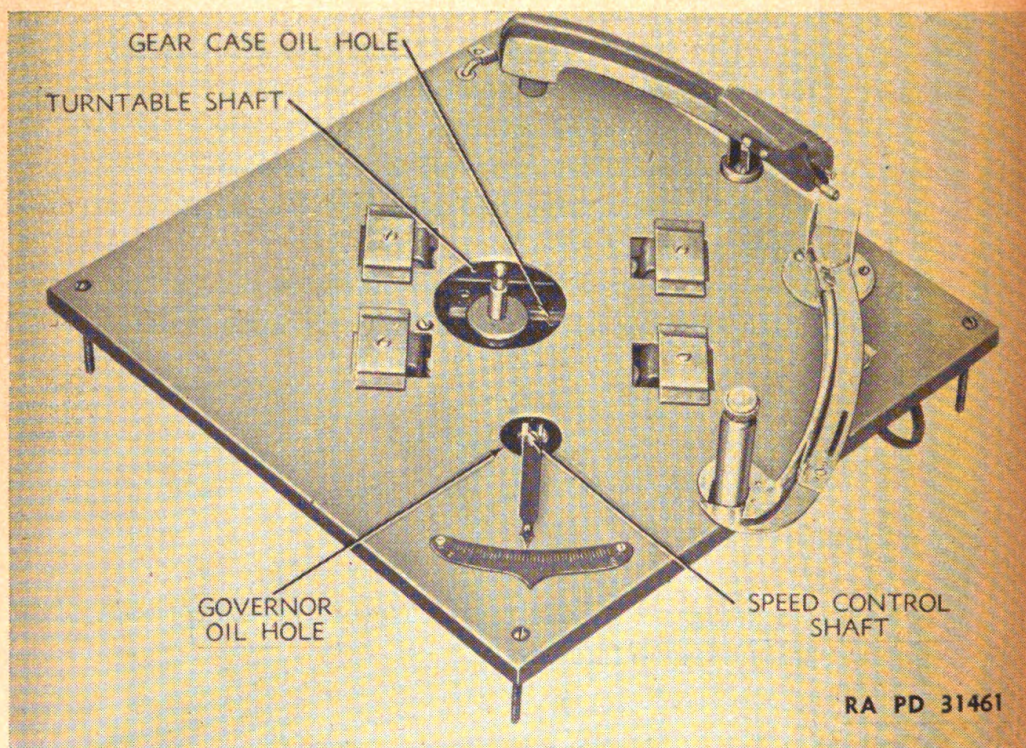
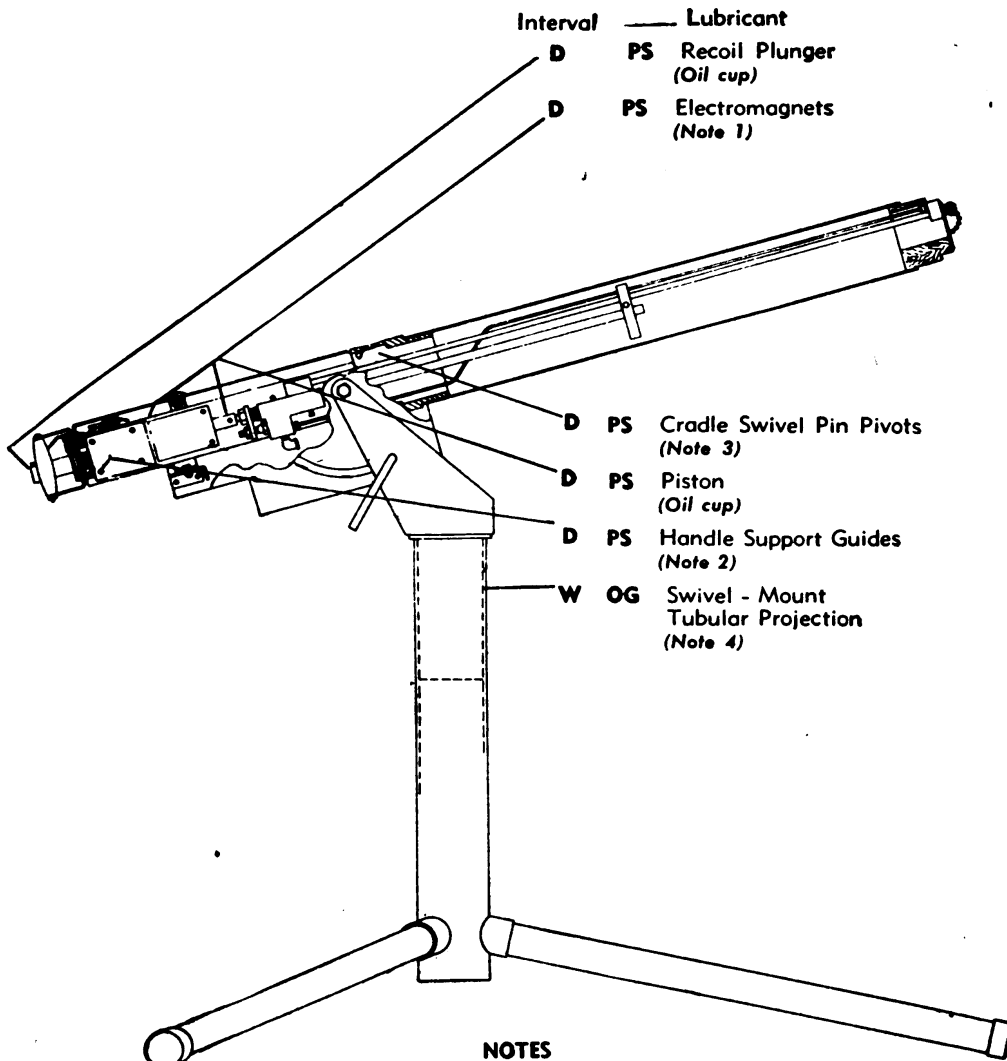


Figure 49.1.—Record Player—Top View, with Turntable Removed

KEY

LUBRICANTS
OG — GREASE, O.D. NO. 0 (above +32° F.) NO. 00 (below +32° F.)
PS — OIL, lubricating, preservative, special

INTERVALS
D — Daily
W — Weekly



NOTES

1. Daily apply 1 or 2 drops to each moving surface of the slides on the electromagnets and recoil mechanism. Avoid any excess oil on electromagnet coils.
2. Daily apply 6 or 8 drops to moving surfaces.
3. Daily apply 1 or 2 drops to pivot points to allow free movement of gun in cradle.
4. Weekly coat surfaces sparingly.

RA PD 60378

Figure 50.—Gun Lubrication Guide

25. SOUND EQUIPMENT.

* * * * *

n. (Added.) If the record player fails to operate, check the circuit continuity from the power source. Be sure the plug on the sound equipment cord is connected to a source of 115-volt 60-cycle current and that the main switch on the control panel is "ON". The record player plug (fig. 52.1) must be inserted into its receptacle in the control panel. It will be necessary to remove the screws holding the

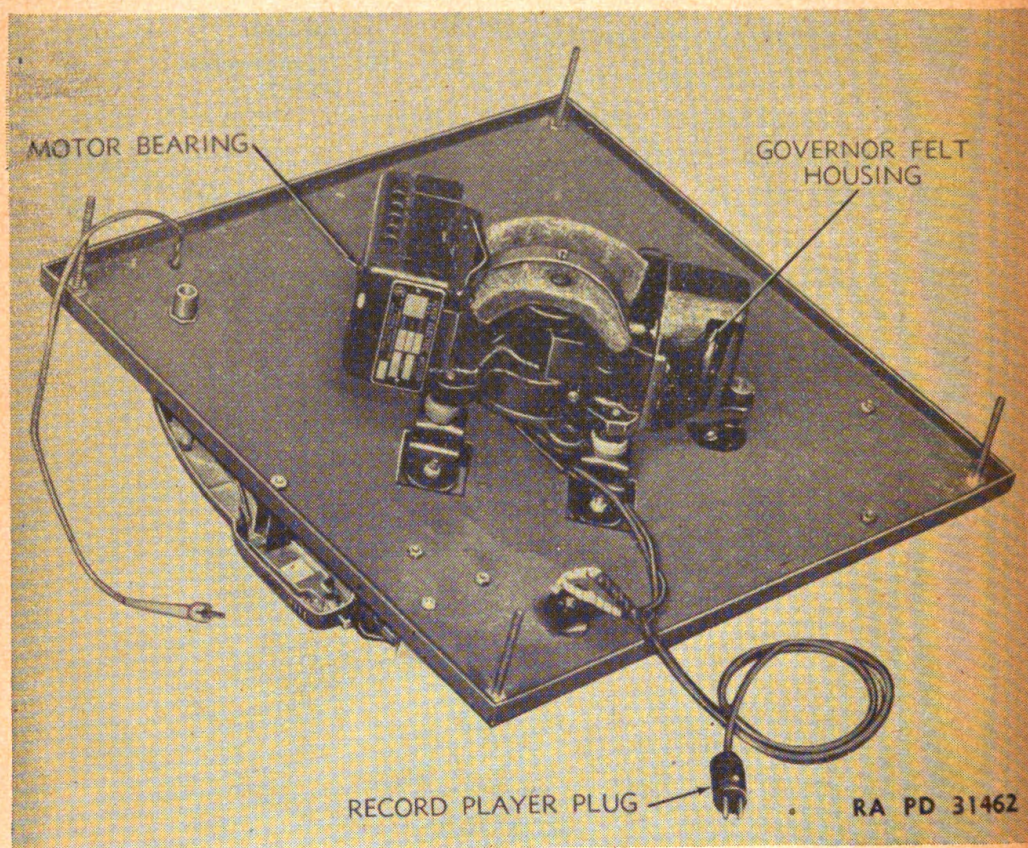
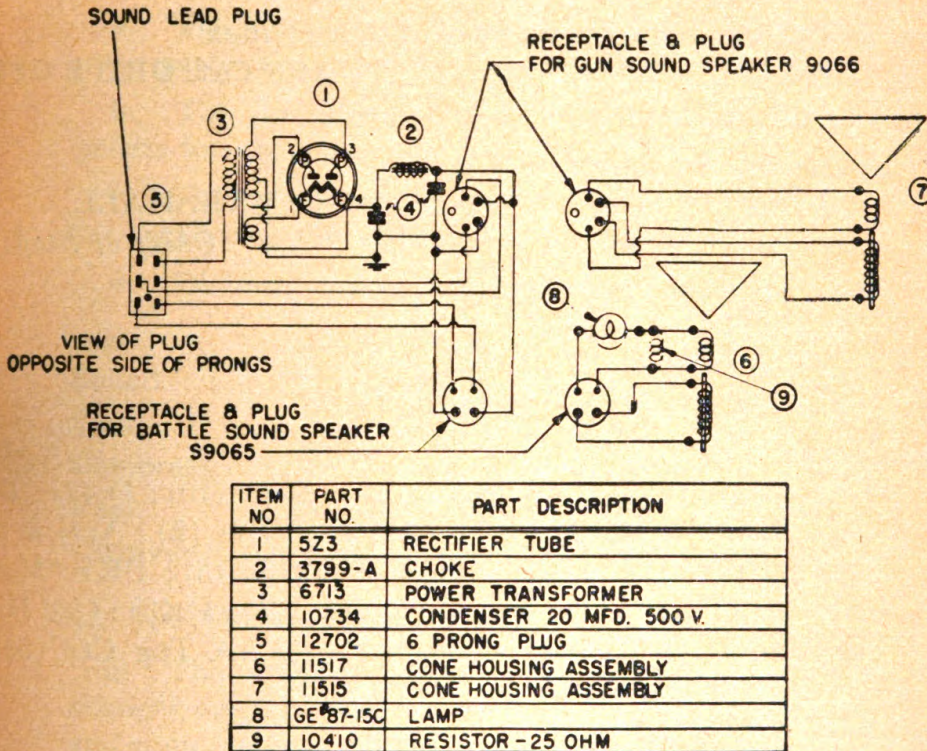


Figure 52.1.—Record Player—Bottom view

control panel in position, and to pull it forward to see if the record player is properly connected. Turn the record player switch "ON". If the turntable does not revolve, it is due to either a faulty switch or motor which must be replaced by authorized personnel.

o. (Added.) If the speed control does not function, pull the turntable (fig. 17.1) from the spindle. See that the nut is tight on the screw so that speed control lever is tightened onto the speed control

shaft (fig. 49.1). The speed control is adjusted as follows: Loosen the nut so that the speed control lever is free on the speed control shaft. Place the turntable over the spindle. Place a white mark on the periphery of the turntable and then turn the switch "ON". The turntable should revolve at 76 to 78 revolutions per minute which can be determined by noting the number of times the white mark revolves in 1 minute. If adjustments are necessary, turn off



RA PD 31463

Figure 60.—Wiring Diagram of Sound Cabinet including Power Supply Unit

the switch and remove the turntable. Turn the speed control shaft one-quarter turn to the right, replace the turntable, and recheck the speed. The adjustment is repeated until the turntable revolves at the required speed. Set the speed control lever midway between "F" and "S" on the scale and retighten the nut, holding the lever to the speed control shaft.

30. STANDARD NOMENCLATURE LISTS.

a. Cleaning, Preserving, Welding, etc.

Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellaneous related items-----	SNL K-1
Soldering, brazing and welding material, gases and related items-----	SNL K-2
Trainer, machine gun, AA, M9-----	F-305

Ordinance Publications for Supply Index (Index
to SNL's)----- ASF Cat. ORD 2 OPSI

[AG 300.7 (6 Sep 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
*Major General,
The Adjutant General.*

DISTRIBUTION:

Armies (10); Corps (10); Sv C (10); Dept (10); D (2); R 4
(2); IBn 9 & 44 (2); IC 9 (3); Tech Svs (2); Arm & Sv
Boards (2); Ord Decentralized Sub-Offs (3); PE's "Mark
for Ord O" (5); Ord Dist O (5); Ord Reg O (3); Ord Dist
Br O (3); Ord Establishments (5); AAA Tng Ctr (50);
AAA Repl Tng Ctr (50).

IBn 9: T/O & E 9-76.

IBn 44: T/O & E 44-15, 44-115, 44-275, 44-325, 44-475T.

IC 9: T/O & E 9-7, 9-9, 9-57, 9-217, 9-318, 9-319, 9-377.

For explanation of symbols, see FM 21-6.

Section II

GENERAL DESCRIPTION

	Paragraph
General description	3
Identification	4
Function	5

3. GENERAL DESCRIPTION.

a. The Antiaircraft Machine Gun Trainer M9 consists of three main parts: the sound equipment, the gun, and the target.

b. The gun is equipped with an ultraviolet lamp and fluorescent pellets for night use.

c. The targets include moving metal airplanes and a paper target for registering the accuracy of aim of the student.

d. Dimensions and weights of components are as follows:

Unit	Length	Width	Height	Approximate Weight
Sound	69 in.	20 in.	88 in.	400 lb
Gun	67 in.	70 in.	52 in.	250 lb
Compressor	44 in.	18 in.	41 in.	400 lb
Reel	47 in.	18 in.	44 in.	40 lb
Ultraviolet Lamp	Included in gun dimensions			15 lb

4. IDENTIFICATION.

a. The sound equipment consists of a cabinet for the record changer, amplifier and the mechanism which originates the firing, recoil, and simulated cal. .50 gun-sound blast; also two large auditorium-type loud speakers.

b. The gun is similar in dimension to the cal. .50 water-cooled antiaircraft machine gun. It is an electrically controlled, pneumatic device for shooting plastic pellets on a 1:30 scale range, to simulate the time of flight of a cal. .50 bullet, under actual firing conditions.

c. The target consists of three miniature airplanes. Each is supported on a steel wire with a tow line attached. One line simulates a straight course, another a dive course, and the third a climbing course.

5. FUNCTION.

a. The Antiaircraft Machine Gun Trainer M9 is used to train gunners using the cal. .50 antiaircraft machine gun. The apparatus is particularly adapted to the selection and training of new gunners. It is also particularly adapted to keep the experienced gunner refreshed on the feel of the gun so that his range adjustments will be made automatically and subconsciously to insure effective antiaircraft fire.

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

Section III

INSTALLATION AND PREPARATION FOR USE

	Paragraph
Installation	6
Preparation for use	7

6. INSTALLATION.

a. Indoor Installation.

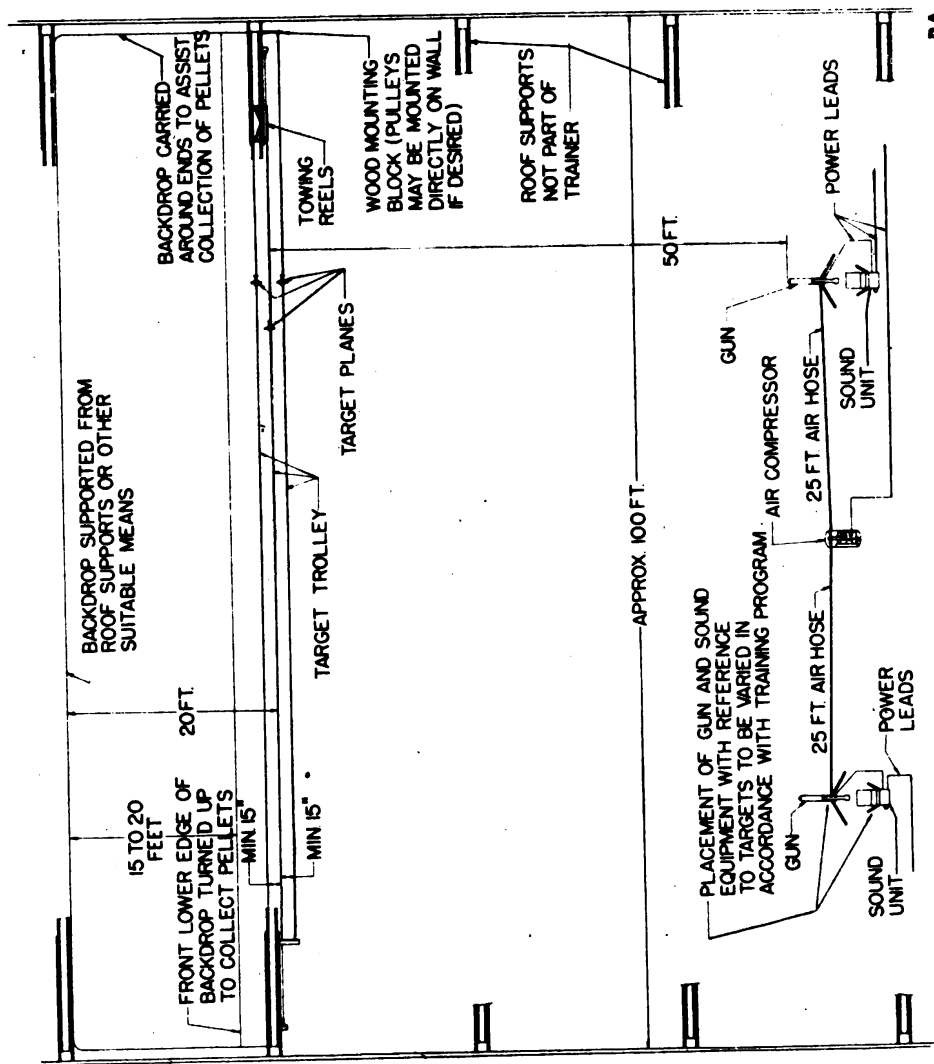
(1) The Antiaircraft Machine Gun Trainer M9 is designed to simulate actual firing conditions, on a 1:30 scale. Hence, in order to simulate the firing at a range of 500 yards, at the targets on a 3,000-yard passing course, the equipment should be set up in some location that will provide a length of from 85 to 100 feet and a width of from 120 to 150 feet. The distance from the gun muzzle to the target plane should be 50 feet. In order that the projectile may present a typical appearance of tracer "cut-back" with reference to its trajectory, it should be free to travel approximately 20 feet beyond the target plane (fig. 1).

(2) The Antiaircraft Machine Gun Trainer M9 will be delivered in seven crates, whose approximate sizes and contents are given in the following table:

74 in. x 31 in. x 14 in.....	Containing one gun and related parts
74 in. x 31 in. x 14 in.....	Containing one gun and related parts
52 in. x 24 in. x 14 in.....	Containing one target assembly
46 in. x 21 in. x 44 in.....	Containing one air compressor
50 in. x 24 in. x 53 in.....	Containing one sound equipment complete
50 in. x 24 in. x 53 in.....	Containing one sound equipment complete
32 in. x 18 in. x 16 in....	Containing one ultraviolet lamp and transformer

(3) Remove the control and sound unit from its crate. Remove the two bolts holding the sound unit to the control unit base, and the four bolts holding the sound unit supports to the top of the control unit. The base members are pivoted so that the ends immediately under the cabinet are pulled together and bolted to the base. The speaker unit supports are then fastened to the front face of the control unit by means of two bolts in each. Two bolts are loosely mounted in the upper ends of the sound unit supports so that the hooks of the sound unit may be placed over the projecting ends of the screws. Nuts are then threaded on to the screws to hold the sound unit supports firmly in position. The cord from the sound unit is then plugged in the speaker outlet on the right-hand side of the control unit. Packing, supporting the record reproducing arm, and equipment in the lower storage compartment should be removed.

ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80260

Figure 2 — Arrangement of Antiaircraft Machine Gun Trainer M9 — Typical Plan View

INSTALLATION AND PREPARATION FOR USE

(4) The complete antiaircraft machine gun trainer unit (or battery) includes two sound units, two guns, one compressor, and one system of targets. In discussing the setting up of this equipment, only one sound unit and one gun will be described, since the set-up of the duplicate units will be identical. For the preliminary set-up, the sound equipment should be located about 65 feet from where the target airplanes will be operated, and about 20 feet to the right of the compressor unit as determined when facing the target (fig. 2). The speaker cabinet portion of the sound equipment should be toward the front or in the direction of the target. This places the controls of the control cabinet to the right as one faces the target (fig. 2).

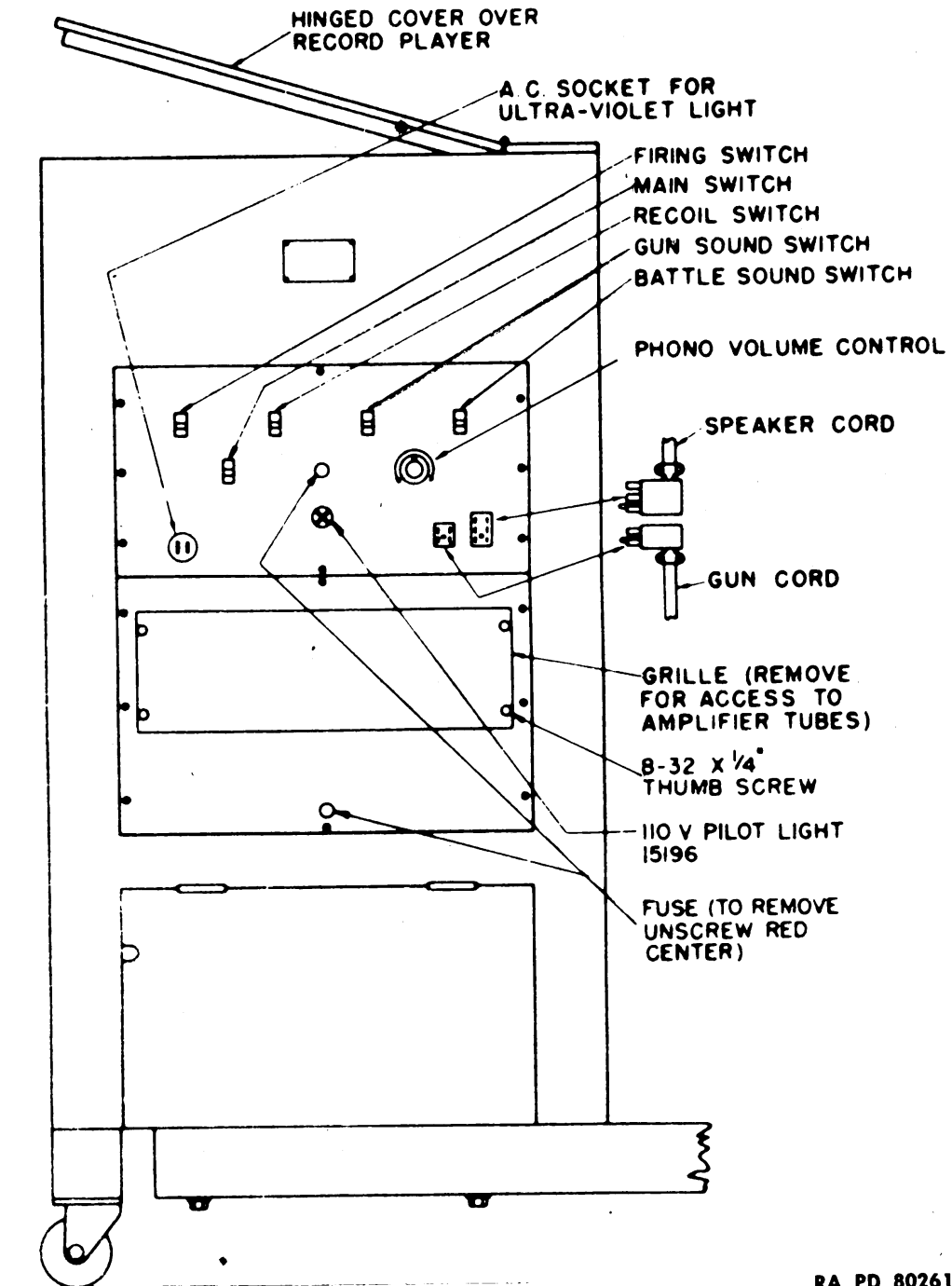
(5) Remove the air compressor from its crate and place it about in the center of the floor space or about 20 feet to the left of the gun in line with the tripod. The pressure gages should be faced away from the target. Connect the air hose to the compressor. Before connecting the air hose to the gun, the hose should be blown free of dirt.

(6) Remove the tripod pedestal from the crate of gun parts and the three tubular legs. Screw them together by hand and set the tripod in front of the sound unit. One leg should be pointed straight ahead along a projection of the centerline of the sound equipment. Check the inner surface of the top part of the tripod to be sure it is free of grit and is lightly lubricated with grease. Lift the gun from the crate and set the tubular projection on the bottom of the swivel mount into the top of the tripod. Before doing this, be sure there is no grit or dirt on the bearing surface of the swivel. Pass the air hose and electrical cord for the gun through the tubular swivel and tripod. Carry the gun cord back to the control unit and plug it into the left of the two outlets in the right lower corner of the control panel (fig. 3). Connect the air hose as shown in figure 36. The handle and trigger of the gun should be approximately 18 inches in front of the center of the horizontal overhead speaker, so that when the student is operating the gun, he will be standing immediately below that portion of the sound unit which produces the explosion sound.

(7) For preliminary use, the targets should be set up 50 feet in advance of the gun muzzle when the gun is pointed away from the sound equipment. For more advanced training, the gun may be shifted to any position with reference to the target so that the plane will approach the gunner at varying angles between the limits of a passing course, and a diving course, in which the plane is diving at the gunner, either from in front, or from behind.

(8) Remove the three target reels and target stand parts from their crate, and assemble them as shown on figure 4. Stand the reel at either end of the proposed line of travel of the target planes. There are three distinct plane courses as shown in figure 6. Each is controlled by one of the reels on the reel assembly. Since the set-up is the same for each of the targets, with the exception of the vertical and horizontal

ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80261

Figure 3 — Control Unit — Right Side

INSTALLATION AND PREPARATION FOR USE

positions of the pulleys, only the set-up for the horizontal course will be described.

(9) Two brackets, one equipped with two pulleys, the other with one pulley, are provided for each course. One should be mounted at either side of the room, on the wall or other vertical support, using the $\frac{1}{4}$ -inch lag screws provided (fig. 5). They should be set sufficiently high so that the gunner will find it necessary to elevate the gun muzzle substantially during his practice. Ideally, the horizontal course should be set up midway between the upper and lower extremes of the diving or climbing courses; however, this may not be practical. It is desirable to have the horizontal course at least 15 or 20 feet above the floor on which the gun is located; if it can be higher, that is more desirable.

(10) With the pulleys mounted the same distance from the floor on either wall, and approximately in line, the trolley wire should be unrolled and attached to the top post on one of the brackets. A bumper spring should be slipped over the wire before attachment is made. In making the attachment by winding the wire around the pulley bracket post, catch the bumper spring so that it will stay fastened to the bracket (fig. 5). The wire is then stretched across the room and attached to the other bracket by means of the turnbuckle supplied. Before making this attachment, measure the approximate length of wire required to reach the second pulley bracket when the turnbuckle is included. Then slip the plane carriage over the wire, and also the second bumper spring, to be fastened to the turnbuckle end of the trolley wire when the trolley wire is connected. With these items accomplished, connect the trolley wire to the bracket by means of the hook on the turnbuckle, and tighten the wire until it supports the weight of the plane satisfactorily.

(11) Thread one end of the towline over the upper pulley closest to the wall on the pulley assembly immediately above the reel, then down to the reel, making one-half turn around the reel pulley from the under side (fig. 5). Carry the towline from the reel up over the lower pulley of the pulley assembly, then through the eyelets on the plane carriage mounted on the trolley wire, and on across the room to the second pulley bracket. Pass the line around the upper pulley closest to the wall, from the under side and back to the plane carriage. Tie it to the plane carriage through the hole provided immediately beneath the trolley roller. Remove as much slack as possible from the towline and cut it so that it can be tied to the opposite side of the plane carriage through the hole provided under the second plane carriage roller.

(12) While either reel may be used on the horizontal target, the one installed parallel to the frame work and on the right end as one faces the hand crank, is a good one for this purpose. This leaves the middle reel for the target trolley placed behind the horizontal wire and the reel on the extreme left for the target placed in front of the horizontal run.

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

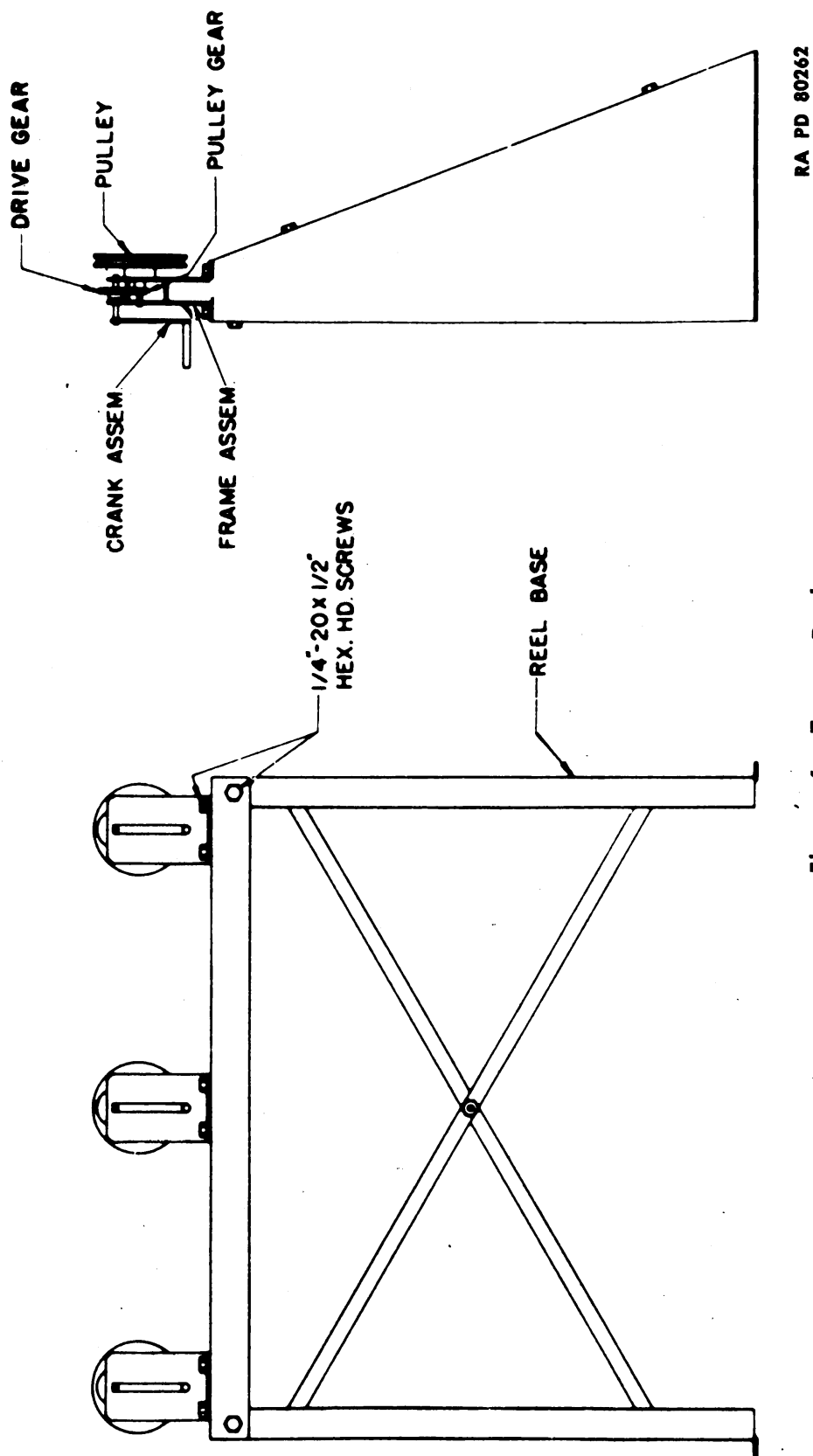
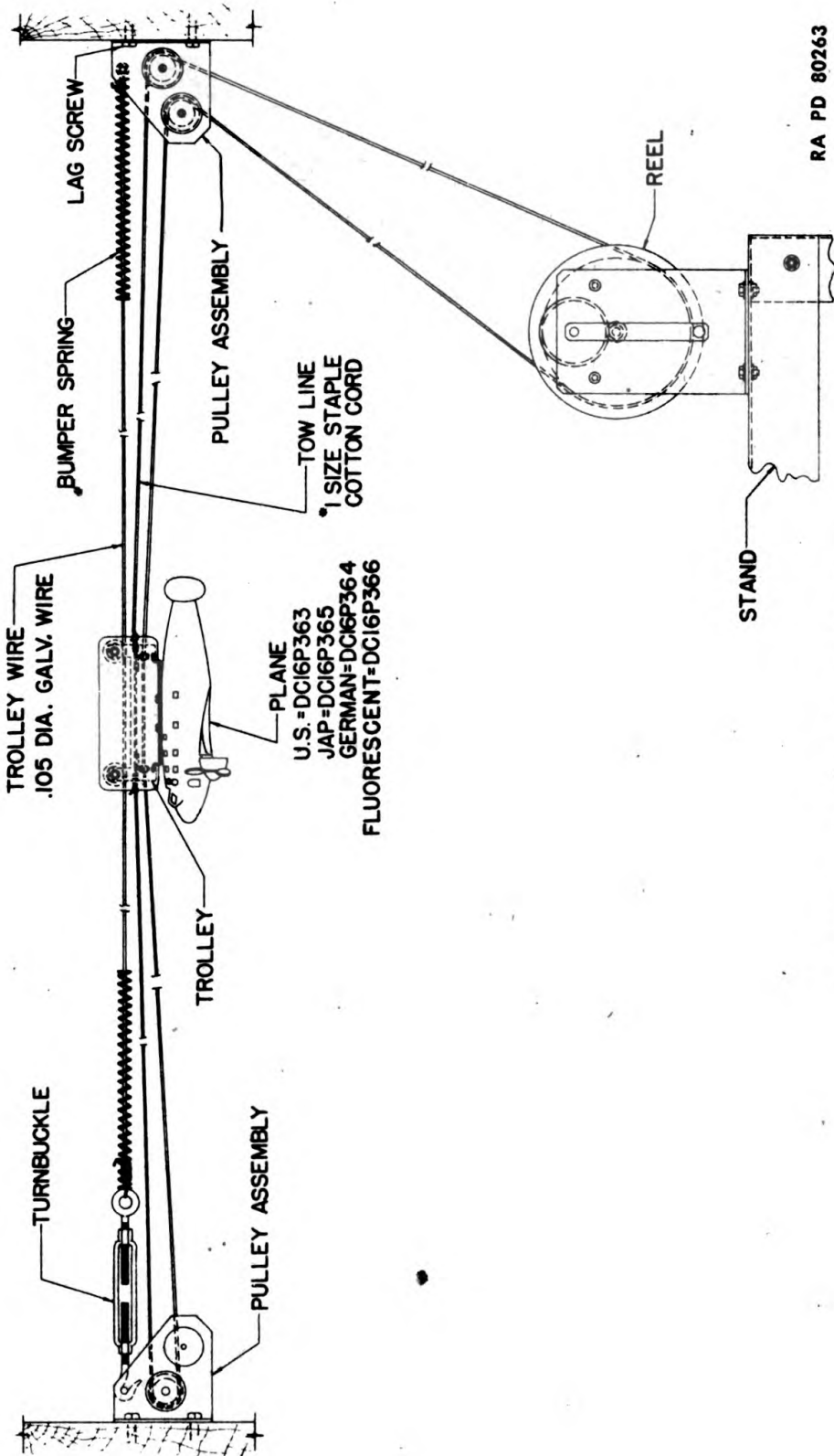


Figure 4 — Target Reel

INSTALLATION AND PREPARATION FOR USE



RA PD 80263

Figure 5 — Typical Target Installation

ANTIAIRCRAFT MACHINE GUN TRAINER M9

(13) If there is a tendency for the reel stand to slide on the floor, in operation, it will be desirable to fasten it in position.

(14) The plane is attached to the plane carriage by simply hooking it in position; it may be pointed in either direction.

(15) The second and third trolleys are set up to provide sloping courses; in one case to simulate a plane on a climbing course, and the other, a plane descending on a diving course (fig. 6). The arrangement is identical with that for the horizontal or passing course, except that the pulley brackets are mounted above one another. For the diving course, the pulley on the reel end is mounted as high as possible. The opposing pulley should be mounted sufficiently low to give a good incline to the trolley. It is suggested that the minimum position of this pulley be 7 feet in order to avoid its being bumped. The pulley brackets must also be mounted either in front of, or behind the horizontal wire, to avoid interference as the planes pass. The minimum distance between wires is 15 inches (fig. 2). As previously explained, if the diving course is mounted behind the horizontal run, it will be convenient to take the towrope to the center reel. The plane, of course, should be hung on the carriage facing downward or toward the left as one faces the target.

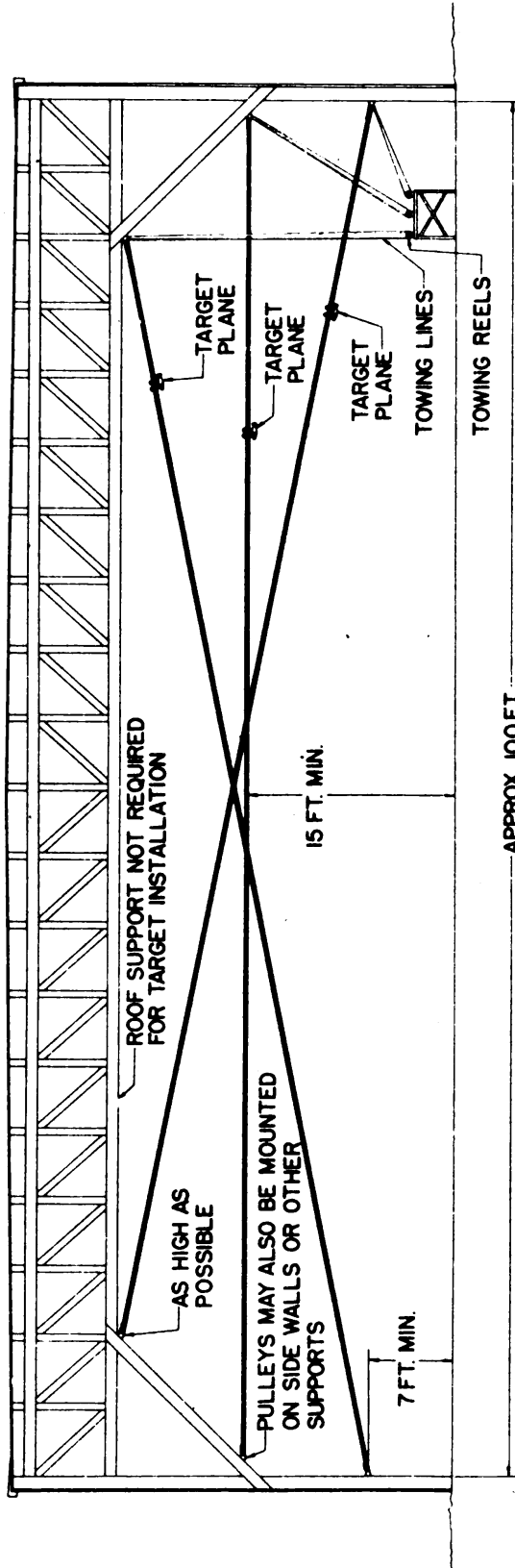
(16) The installation of the climbing course, is exactly the same as that for the diving course, except that the bracket immediately above the reel is lower than the one on the opposite wall.

(17) One function of the Trainer M9 is to provide an inexpensive projectile which can be safely used indoors and can be readily seen. The best visibility is obtained by shooting white pellets against a dark background. It is also helpful to be able to collect the pellets easily after they have been discharged from the gun. A dark green or black target cloth back drop, hung approximately 20 feet behind the target is quite satisfactory for this purpose. The back drop should be at least 20 feet wider than the useful range of the trolley wires. The excess material should be provided so that there is some material on either side of the firing area. It should be hung from a point sufficiently above the highest point to which the target planes will be fired upon, in order to catch any pellets inadvertently fired at somewhat higher elevations than necessary. If the top of the target cloth is 6 or 8 feet above the maximum height of the trolley wires in the firing range, it should be satisfactory.

(18) To supply a successful background, the target cloth should drop sufficiently low so as to be 8 to 10 feet below the lowest point to which planes will be fired upon. This will provide a sufficiently large dark background to produce a good tracer "cut-back" of the pellet, as it passes beyond the target and curves downward, behind the target.

(19) The pellets supplied with the gun can be used over and

INSTALLATION AND PREPARATION FOR USE



RA PD 80264

Figure 6 — Typical Daytime Indoor Target Installation — Schematic Elevation

ANTIAIRCRAFT MACHINE GUN TRAINER M9

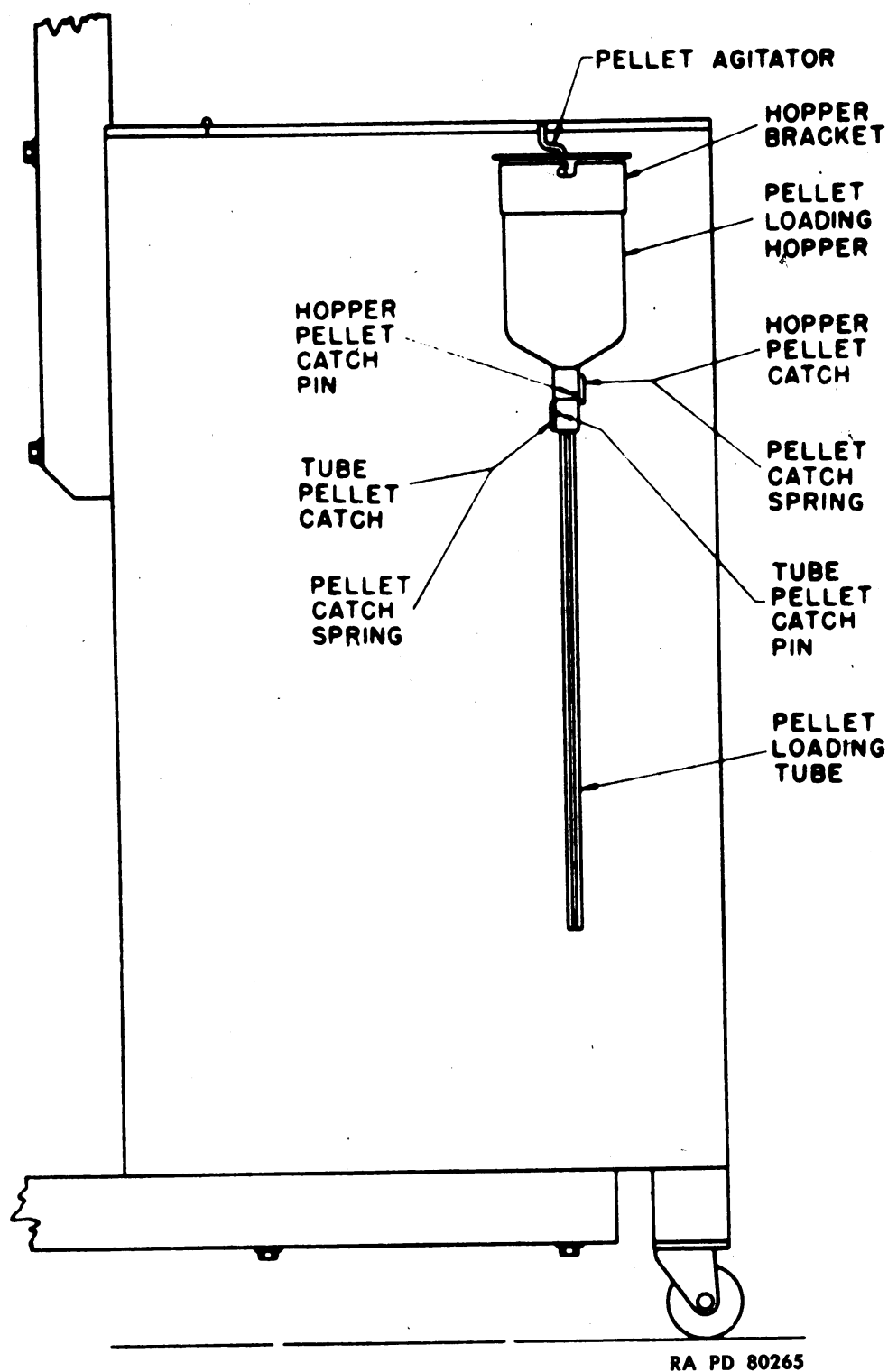


Figure 7 — Loading Tube Under Pellet Loading Hopper

INSTALLATION AND PREPARATION FOR USE

over again many times if kept clean. It is quite important that dirt be kept out of the system, as foreign particles may cause the pellets to jam in the magazine tube or in the gun barrel. The simplest way to collect the pellets is to provide some type of floor cloth or tarpaulin under, and in front of, the back drop. As the balls strike the back drop, they will tend to bounce forward and then, upon falling on a solid surface, may bounce a second time. It is, therefore, necessary to have the collecting cloth extend 15 to 20 feet in front of the back drop. In order to accumulate all the balls in a limited area, it is desirable to raise the cloth along the front and back edges so that the balls tend to roll in one line. This can be further improved by lifting the ends of the ground cloth, thus causing the pellets to accumulate in a pile in the center. Wherever possible, it is desirable to make the back drop sufficiently large on the vertical dimension so that it can be dropped to the floor and then be carried forward on the floor, then upward about 2 feet, as shown in figure 1.

(20) A pellet hopper is provided for each gun, to facilitate loading. This should be mounted on the left side of the control cabinet (fig. 7).

(21) Each Trainer M9 includes four planes and two packages of pellets. Three of the planes are intended for use in daylight. They bear the insignia of the United States, Germany, and Japan respectively. The fourth plane, which is without insignia, is for use in night operation. One group of pellets is white for use in daylight and the other is red for night operation. In setting up for day operation of the gun, be sure that the three planes with insignia, are used on the target carriages and the white pellets are used in the gun.

(22) NIGHT OPERATION.

(a) For night operation, it is necessary to attach an ultraviolet light to the under side of the gun barrel water jacket (figs. 8 and 46). The lamp is shipped knocked down. Insert the bulb in the socket; lay the lens in place. Hold the lens in place with the clamping ring. Set the transformer on the floor and plug the cord into outlet on the lower left corner of the control panel as shown in figure 3, plug the lamp into the outlet on the transformer, and snap the switch to "ON." When the light is mounted and operating, the screws holding the swivel clamps in position should be loosened slightly and the light checked to be sure it is properly focused. To do this, lock the gun swivel in such a position that when the gun is fired, the pellets will strike the fluorescent or unidentified plane held stationary on trolley wire in the field of fire. Adjust the light beam so that it is focused on the plane. When the adjustment is completed, lock the clamping nuts securely in position.

(b) Remove all white pellets from the loading hopper and gun magazine and floor, and substitute the red pellets. Also select the

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

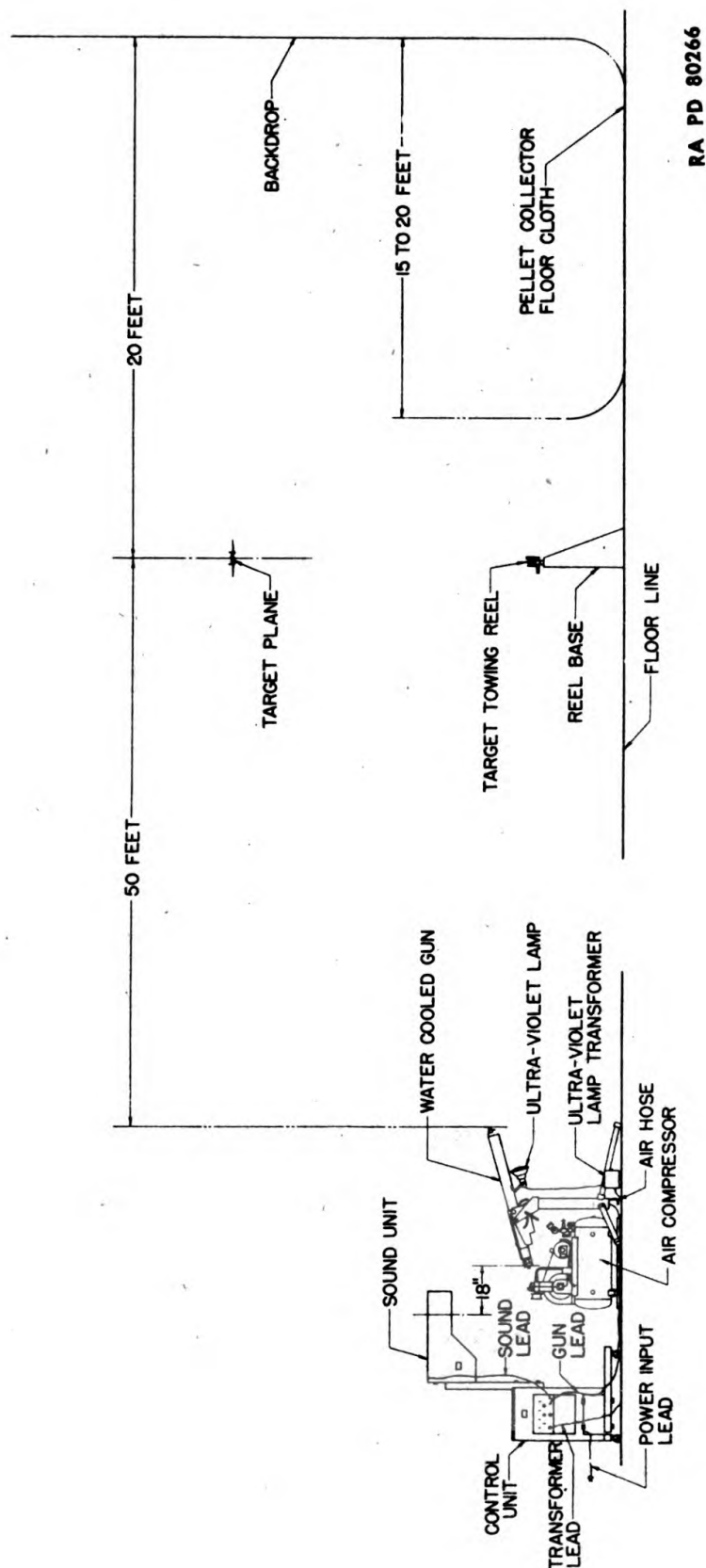


Figure 8 — Trainer for Night Use with Ultraviolet Lamp — Schematic Outline

INSTALLATION AND PREPARATION FOR USE

RA PD 80267

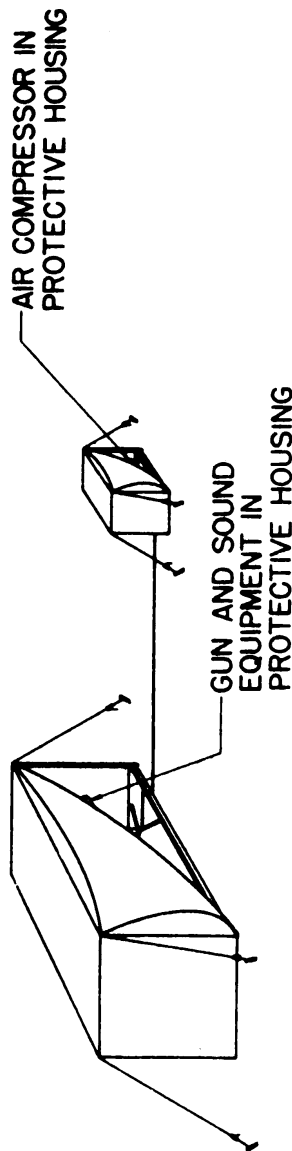
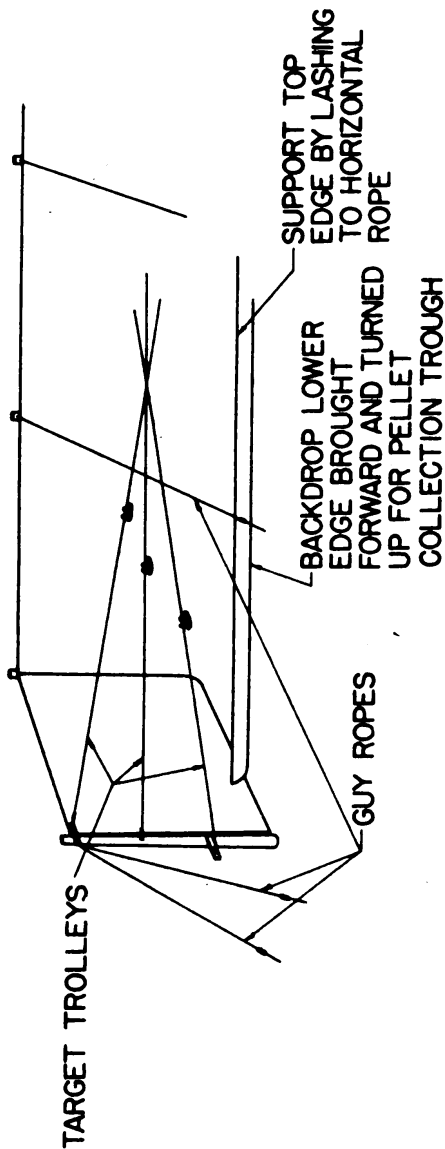


Figure 9 — Outdoor Target Arrangement — Perspective Sketch

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

course desired and replace the plane with the fourth plane, which has no insignia.

(c) The plane for night use is finished with both phosphorescent and fluorescent paint. This makes the plane visible either with or without the ultraviolet light. The visibility is about like that of a plane in the beam of a searchlight. The red pellets contain a suitable fluorescent dye, which causes them to become visible as they pass through the ultraviolet light on their course.

CAUTION: The rays produced by the ultraviolet lamp are similar in quality to those in bright sunlight. Excess exposure may lead to some discomfort of the eyes, just as looking directly at the sun. All students awaiting their turn to fire the gun should, therefore, be kept behind the source of ultraviolet light while the lamp is in operation, and should avoid looking directly at it. Each man assigned to the duty of keeping the magazine properly charged with pellets must be careful to avoid looking at the lamp as much as possible. All target reel operators must be supplied with a protective screen.

b. Outdoor Installations.

(1) In order readily to obtain a location for setting up the Antiaircraft Machine Gun Trainer M9, and provide targets at a high angle of elevation for the gun, it may be desirable to set the equipment out of doors. The general area required for the equipment will be similar to that outlined for indoor installations in the previous paragraphs and shown in figures 1, 2, 5, and 6.

(2) Each piece of equipment or group of pieces, such as the gun sound equipment, should be set on a protected location or platform to assist in keeping them dry during rainy weather, unless the equipment is to be moved to sheltered quarters in the event of a storm. The target trolley wire pulley brackets can readily be mounted on wood poles similar to those used to carry telephone wires (fig. 9). In mounting the inclined wires, care should be taken that the low end of the wire is sufficiently high so as not to obstruct the normal traffic that must pass under it. In setting up the trolley wire, it is desirable to elevate it sufficiently so that the gun must be operated at a relatively high angle of elevation. This will tend to simulate field firing more closely.

(3) It is highly desirable to mount a back drop of some sort behind the targets to provide a background to fire against, and to assist in collecting the balls. The procedure outlined for the indoor back drop may be followed in this case, except that it will probably be necessary to support the back drop from a wire stretched between several posts (fig. 9). In addition, it will be necessary to tie the back drop at several points from top to bottom, and wherever possible, to cut air vents in it, to reduce the tendency of the wind to tear it away from the supports.

CAUTION: If the pellets are to be collected for re-use, care must

INSTALLATION AND PREPARATION FOR USE

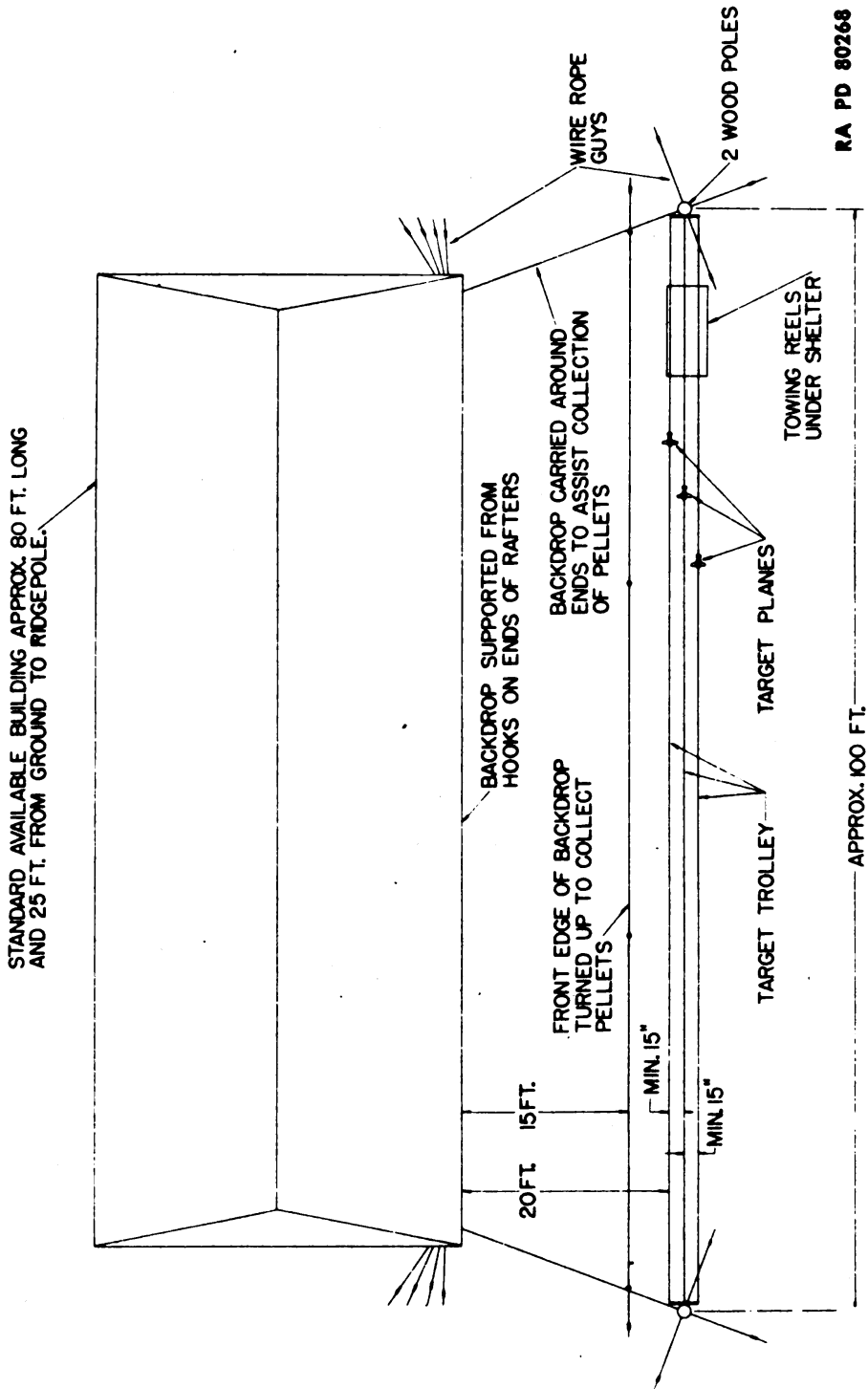
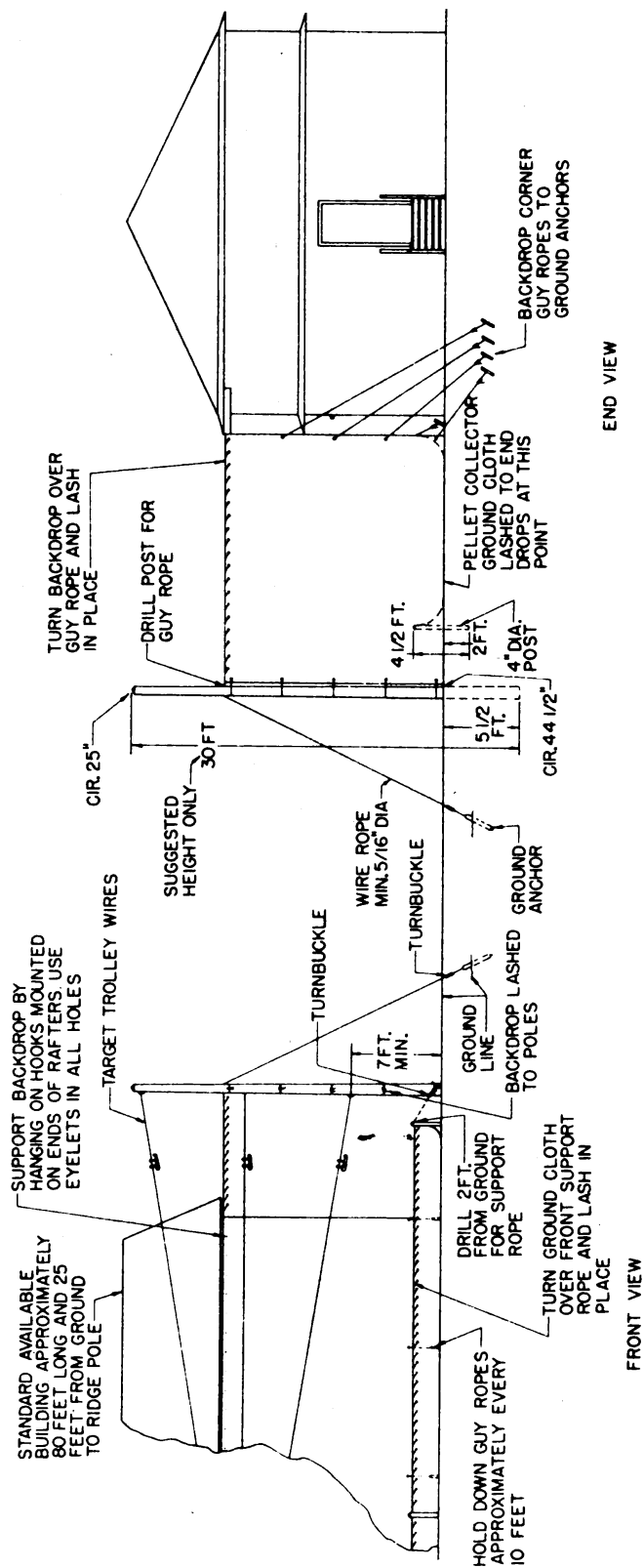


Figure 10 — Arrangement of Trainer for Outdoor Operation — Typical Plan View

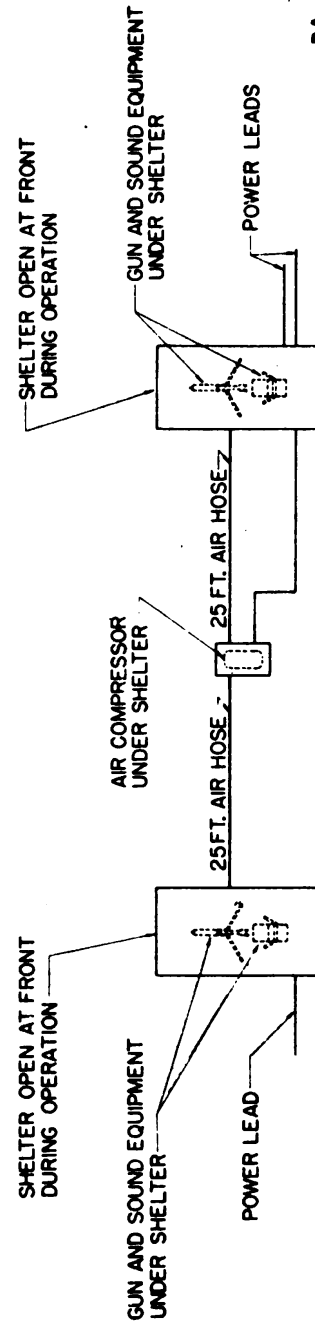
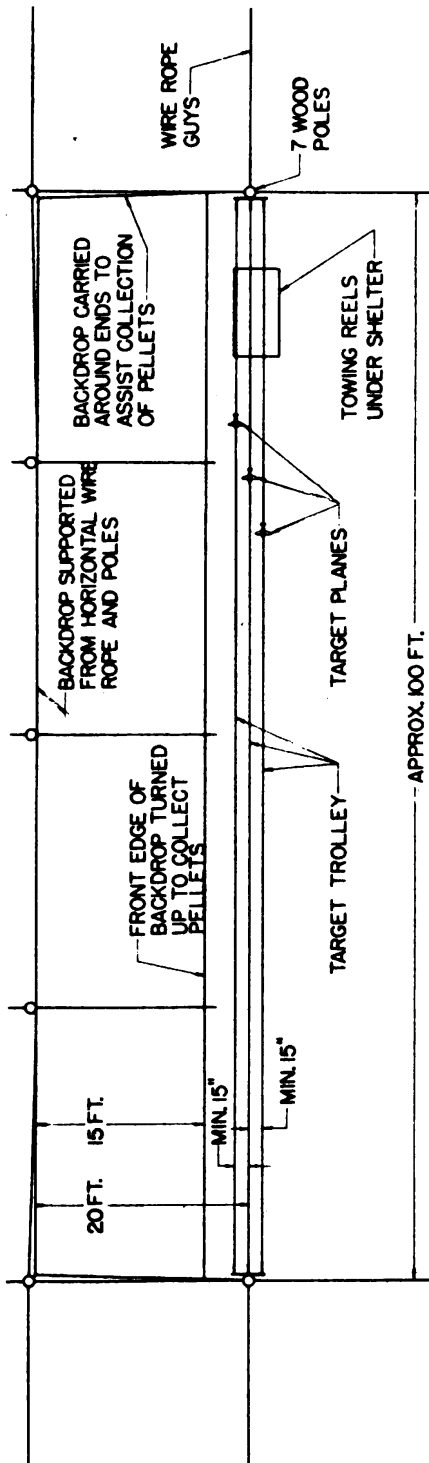
ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80269

Figure 11 — Corner of Outdoor Back Drop — Alternative No. 1 — Front and End Views

INSTALLATION AND PREPARATION FOR USE



RA PD 80270

Figure 12 — Arrangement of Trainer for Outdoor Operation — Alternative No. 2 — Typical Plan View

ANTIAIRCRAFT MACHINE GUN TRAINER M9

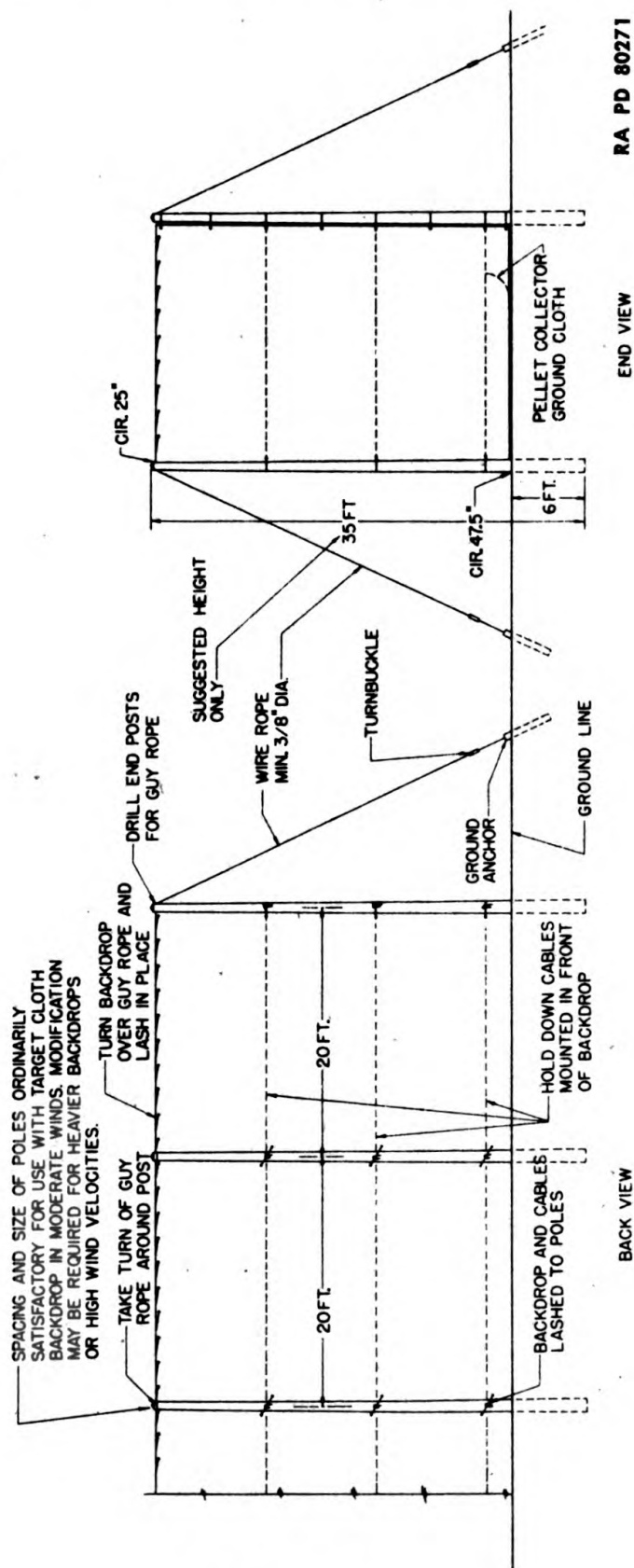


Figure 13 — Corner of Outdoor Back Drop — Alternative No. 2 — Back and End Views

INSTALLATION AND PREPARATION FOR USE

be taken to keep them clean. Balls that become definitely dirty, will not only be likely to introduce dirt into the gun barrel and cause a tendency to jam, but will also be difficult to see.

(4) Dirty balls may be readily cleaned by washing in soapy water. One satisfactory way to do this is to put them in a screen wire basket or perforated can and shake them while submerged in warm soapy water; then rinse well, and to dry, either pour out on a cloth or allow them to drain. Do not leave the pellets standing in water more than the normal time required for the washing operation. Excessive exposure to water may cause swelling and consequent jamming in the gun barrel.

(5) Equipment installed out of doors must be protected from the elements. Each unit must be covered with a suitable tarpaulin when not in use.

(6) In some cases, it may be advantageous to train out of doors with moving targets without a back drop. While in most cases, this will result in the loss of the pellets, the actual expense involved will be considerably less than training with actual gun fire, and little strategic materiel will be used. The availability of this equipment for use at any time, makes it desirable for preliminary instruction, even under these conditions.

7. PREPARATION FOR USE.

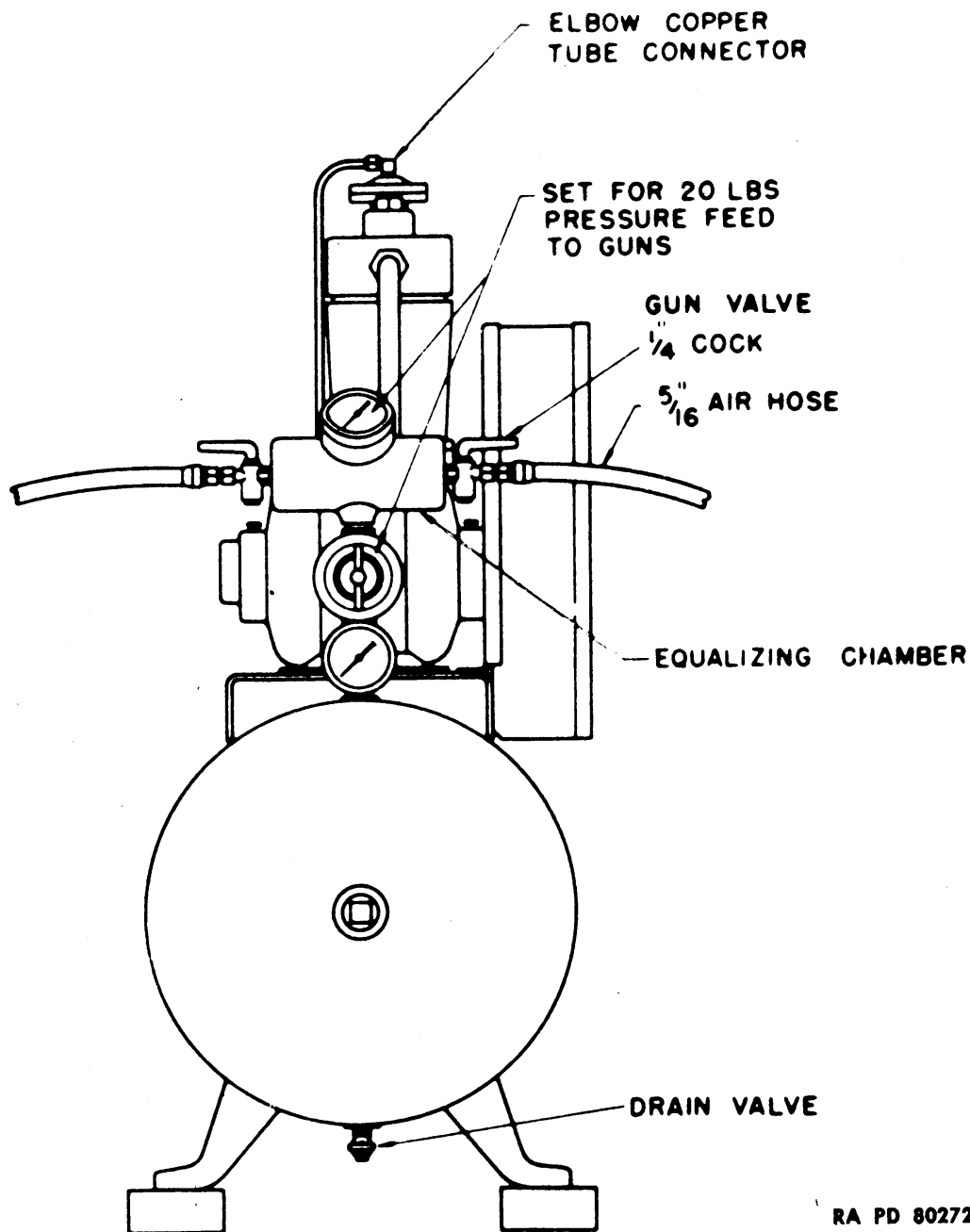
a. With the equipment assembled as directed in paragraph 6, the assembly should be as shown in figure 1, showing a schematic outline of the Antiaircraft Machine Gun Trainer M9. The equipment should be inspected to be sure that no major damage has been done to it in shipping, such as apparent loosening or breaking of parts, etc.

b. The compressor is shipped without oil in the crankcase; therefore, it must be filled and inspected to be sure that there is sufficient oil present. A short gage rod is attached to the thumbscrew on the end of the compressor pump opposite the discharge end (fig. 38). The crankcase should have oil up to the "FULL" mark. If for any reason, it has fallen below the "LOW" mark, add oil to "FULL" mark.

c. The battle sound records will be found packed in the storage cabinet of the control unit. They should be placed in position ready for operation on the record changer.

d. Before proceeding with the trial of the equipment, the battle sound should be checked. It is desirable to become familiar with the procedure involved in operating the reproducing equipment for providing the battle sound. The changer plays up to fourteen 10-inch or ten 12-inch records at one loading. Figure 15 shows the setting for a 10-inch record, if several records are to be used in one set-up. See that the selecting arms are both turned toward the center turntable and that both arms are set for the correct size records. Place the stack of

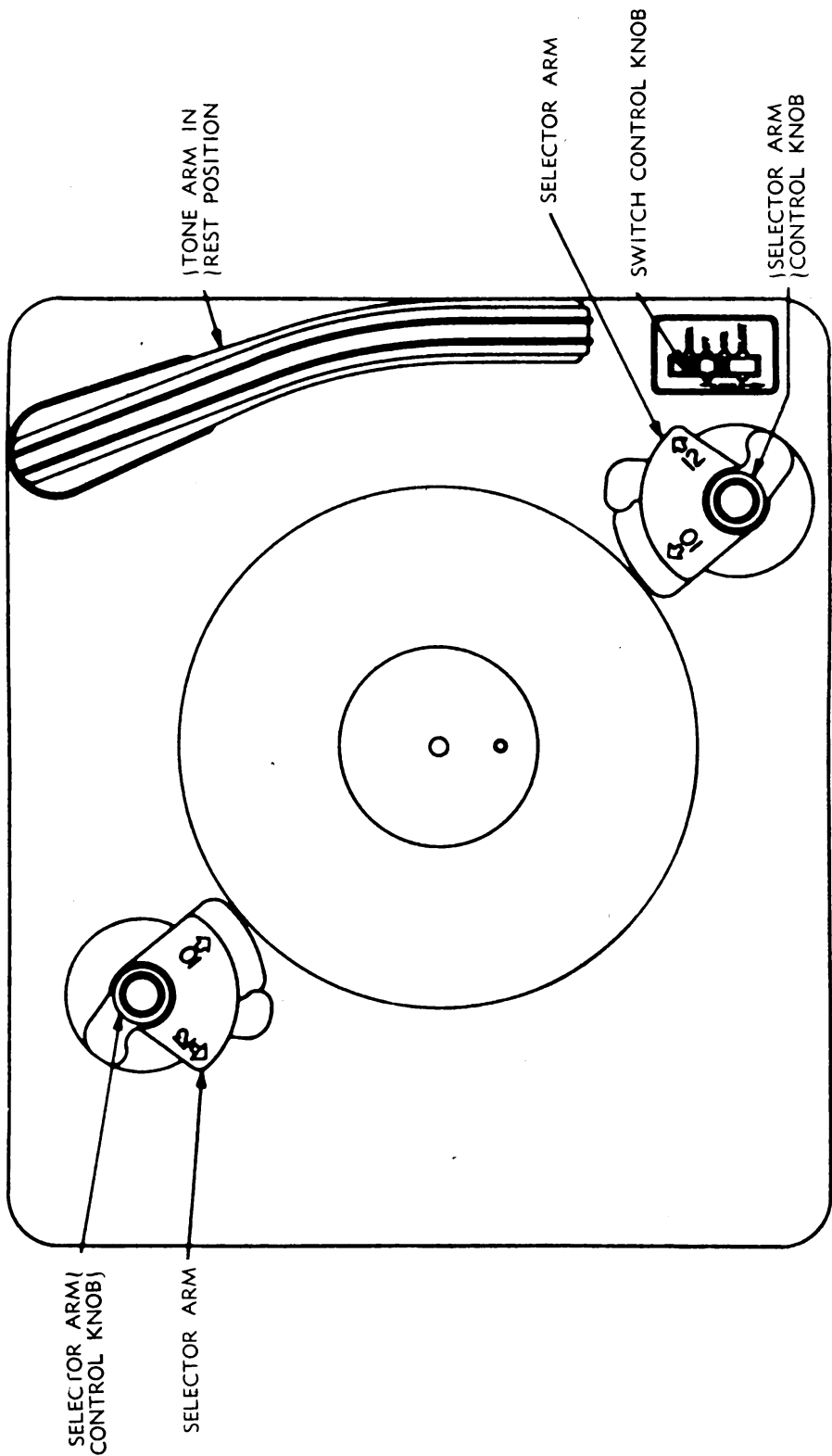
ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80272

Figure 14 — Compressor Showing Gage Setting

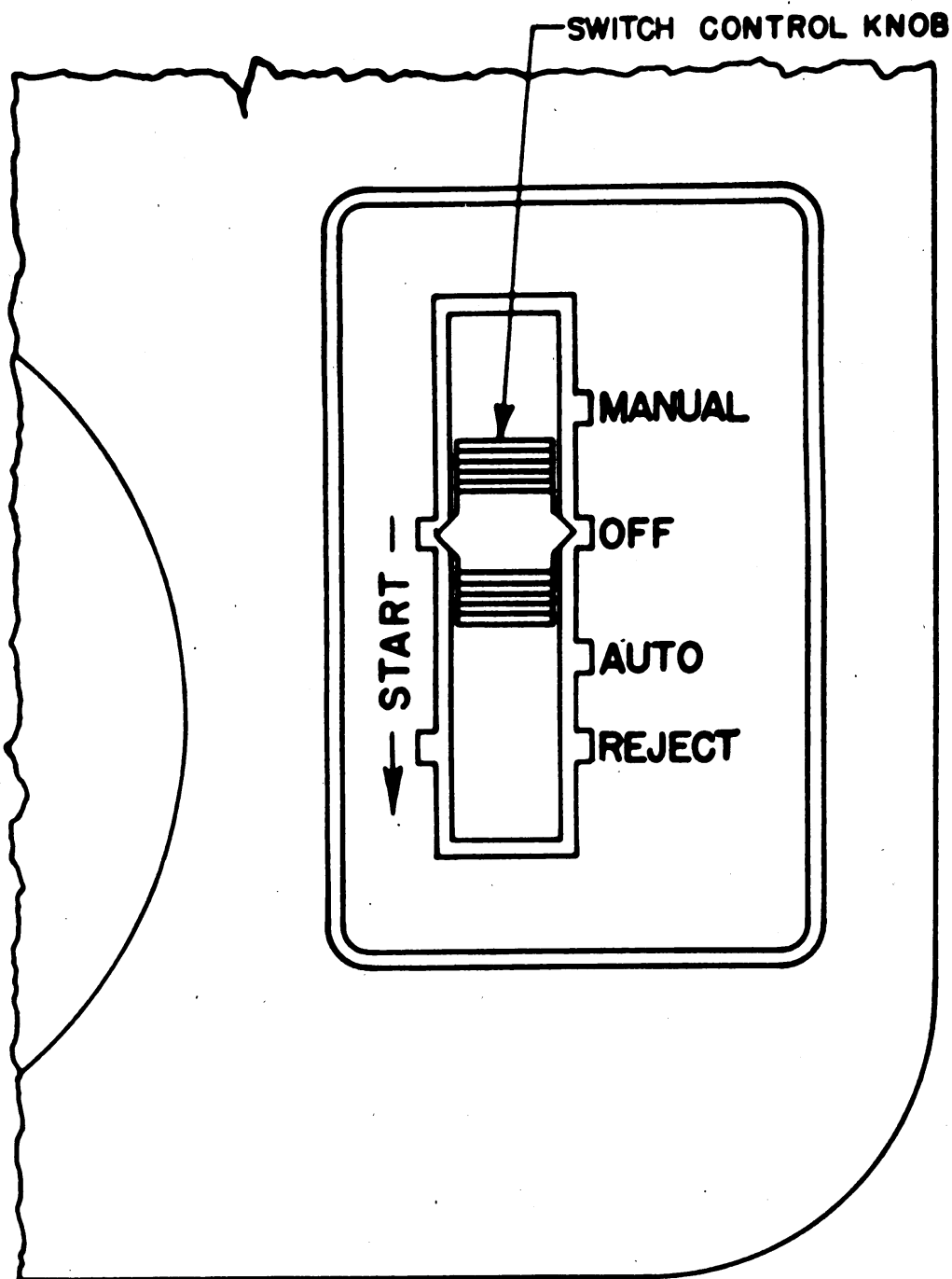
INSTALLATION AND PREPARATION FOR USE



RA PD 80273

Figure 15 — Record Changer Showing Selector Arm Set for 10-inch Records — Top View

ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80274

Figure 16 — Record Changer Control

INSTALLATION AND PREPARATION FOR USE

records of the size indicated on the arms, over the center pin so that they will rest on the selecting arms. The record changer should then be ready for operation. If a single record is to be used, as is intended for the normal operation of the battle sound, the single record is placed on top of the arms as would be the case for loading several records in position. The machine is then ready for operation. To produce the battle sound, plug power input cord into a convenient socket, move the record changer switch knob to the "REJECT" position (fig. 16). The motor will start. The record changer will go into automatic operation. If at any time it is desired to stop the reproducing equipment, move the switch knob on the changer to "REJECT" and then to "OFF" position. This can be done at any time after the needle comes in contact with the record. The reproducing equipment will not operate if the main switch on the right side of the control cabinet is not in the "ON" position.

CAUTION: Always have the turntable control knob in the "MANUAL" position when tone arm is moved manually. Failure to do this will injure the tone arm mechanism.

e. Operating as outlined in subparagraph d above, test the battle sound to be sure that it is operating correctly. To produce the battle sound, place the record on the turntable. With the main switch on the control cabinet turned to the "ON" position, move the turntable control knob to "REJECT" (fig. 15); then snap the battle sound switch to the "ON" position. The battle sound switch controls a shunt, which in the "OFF" position short-circuits the crystal pick-up in the record changer so that the battle sound is not audibly reproduced. This makes it possible to leave the record changer turntable running with the record in place. The battle sound may be cut in and out of the system instantly as desired, without the delay encountered in starting up the turntable or warming up the amplifier. In order to provide a switch for the battle sound that will open or close a shunt and also indicate "ON" or "OFF" properly, it has been necessary to reverse the mercury element in the battle sound switch.

CAUTION: The battle sound switch does not have the mercury element mounted in it for regular operation, as do the other switches. In servicing, keep this in mind.

f. With the repetition of subparagraph d above, and with the battle sound cut into the system, the complete equipment should be ready for operation. All of the sound effects have been set to be focused on the gun pointer and hence will not be quite as effective to anyone standing beside the equipment.

g. The volume of the sound may be modified by the volume knob mounted on the control cabinet panel (fig. 3).

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

Section IV

OPERATION

Paragraph

Trial operation	8
Final instructions	9

8. TRIAL OPERATION.

a. When the inspection of the assembly of the various units has been completed and if the input leads of the control units and compressor have been disconnected, plug them into a source of 110-volt, 60-cycle current. When the compressor is plugged into a source of power, it will start immediately. Be sure the drain cock is closed and the gun valve opened (fig. 14). The compressor should shut off automatically at approximately 65 to 70 pounds pressure, as shown by the pressure gage on the tank. The air regulating valve should be adjusted to a 20-pound pressure, so that when the guns are operated, they will be operating at that pressure (fig. 14).

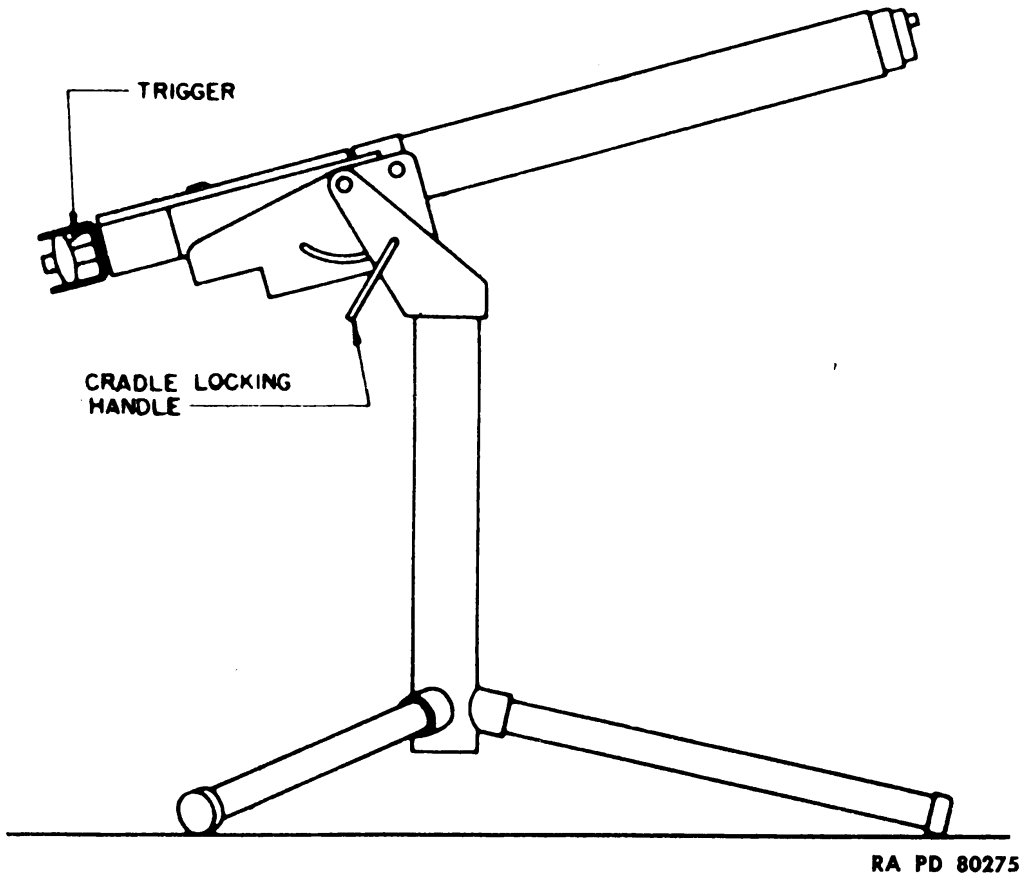
CAUTION: Changing the air pressure will change the time of flight of the pellets. The correct pressure is 20 pounds, which produces a time of flight of approximately 0.58 second. This is comparable to the 0.62 second required for a cal. .50 bullet to travel from the gun muzzle to a target at a 500-yard range.

b. Snap main switch to "ON," which energizes the timer and timer motor, the battle sound amplifier and speakers, the record changer motor, and the ultraviolet light outlet.

c. Snap the firing switch on the right side of the control unit to the "ON" position (fig. 3). With all the other switches on the control except the main switch in the "OFF" position, depress the trigger on the gun (fig. 17). This should cause the gun to produce a clicking sound, indicating that the firing piston is operating. While the clicking sound will not be loud, it should be positive. The gun is adjusted to simulate the fire of a cal. .50 machine gun firing 600 rounds per minute. The pellets simulate the tracer stream, which in this case is one shot in every five; therefore, the firing pin should operate approximately 120 times per minute. The number of operations of the firing pin is controlled by the timer, and is not likely to be incorrect. Any sluggishness of action will probably be due to poor voltage on the line, or to excessive friction in the electromagnet, due to the accumulation of grease and dirt. Dirt, of course, should not be the cause of trouble with new equipment; hence, the voltage is the most likely source of sluggish action in this case.

NOTE: Like the cal. .50 gun, firing will be erratic if the trigger is not depressed completely.

OPERATION



RA PD 80275

Figure 17 — View of Gun Showing Trigger and Cradle Clamp

d. Assuming that the gun seems to be operating correctly when tested, as described in subparagraph c, above, snap the recoil switch to the "ON" position, and repeat the test by pressing the trigger. The firing pin then should operate to fire approximately 120 pellets per minute to simulate the tracer stream, and the hand grips should vibrate to simulate the recoil effect on the cal. .50 gun firing 600 rounds per minute. The recoil effect should be approximately that of firing a cal. .50 gun. If the recoil seems insufficient and the line voltage has been checked to insure the delivery of 110 volts to the control unit, some minor adjustments may be necessary to improve the quality of the vibration. Such adjustments are discussed in detail in section VI.

e. With the gun sound switch snapped to the "ON" position, pressing the trigger should cause the firing pin to move as before and the recoil to take place, also a simulated sound of the muzzle blast should occur to represent the firing of 600 rounds per minute.

If the main switch has been turned to "OFF," the sound effects will not appear at once if the gun is fired immediately after turning the main switch to "ON." This is because, about 4 seconds are required for the speaker field coils to build up sufficient energy to

ANTIAIRCRAFT MACHINE GUN TRAINER M9

operate normally—also the battle sound amplifier tubes must become warm.

NOTE: The muzzle blast sound effect is intended for use with the recoil effect. If the recoil is cut off and the gun sound operated, there may be distortion of the sound due to disturbances set up. These disturbances are normal and will disappear when the recoil effect is produced with the gun sound.

f. To be sure complete equipment is operating correctly, repeat instructions in preceding subparagraph, utilizing the battle sound. To produce the battle sound, place the record on the turntable. With the main switch on the control cabinet turned to the "ON" position, move the turn table control knob to "REJECT" (fig. 15); then snap the battle sound switch to the "ON" position. It is often desirable to leave the record changer turntable running, with the record in place. The battle sound may then be cut in and out of the system as desired, without the delay encountered in starting up the turntable. With the repetition of instructions in subparagraph c above and with the battle sound in the system, the complete equipment should be in operation. All of the sound effects have been set to be focused on the gun pointer and hence will not be quite as effective to anyone standing alongside the equipment.

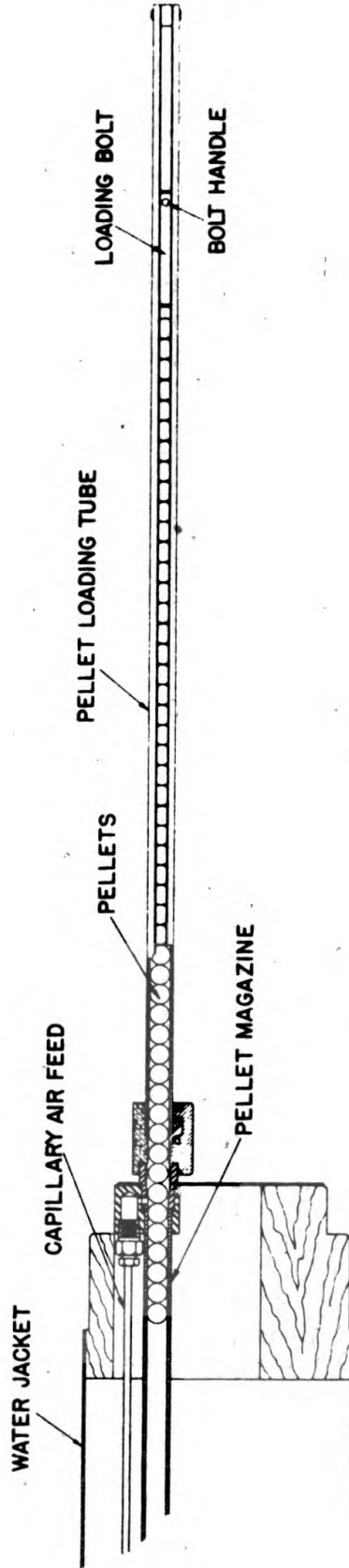
CAUTION: Always have switch control knob in manual position when the tone arm is moved manually. Failure to do this will injure the one arm mechanism.

g. The volume of the battle sound may be modified by the volume knob, mounted on the control cabinet panel (fig. 3).

h. The gun is now ready for trial operation with pellets. A pellet-loading hopper and a loading tube, are provided to facilitate loading pellets into the magazine of the gun. A quantity of pellets is placed in the loading hopper, which feeds them through its funnel-like bottom into a loading tube. In order to assist their discharge through the bottom, a hand crank is provided to stir the balls. Holding the enlarged end of the loading tube against the bottom of the loading hopper releases a detent, and allows the pellets to fall into the loading tube (fig. 7). The loading tube holds 50 pellets. The gun magazine will hold 125 pellets. In ordinary practice it is well to use only one loading tube full each time the magazine is refilled. Each pellet represents the tracer bullet, one out of every five shots fired by a cal. .50 gun. Since the magazine of a standard gun normally holds 250 rounds, 50 tracers in the trainer will represent the extent of the ammunition available, without refilling the magazine. The use of this quantity in the trainer gives the student an appreciation of the length of time his ammunition will last.

i. Pellets are transferred from the loading tube to the magazine at the muzzle end of the gun (fig. 18). The magazine plug is un-

OPERATION



RA PD 80276

Figure 18 — Loading Tube in Position to Load Magazine

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

screwed, and the end of the loader, previously held against the under side of the loading hopper, is supported against the end of the magazine tube. The sliding bolt within the tube is then moved toward the gun to transfer the pellets from the loading tube into the magazine.

CAUTION: Always turn the "firing" switch to "OFF" before loading. This will prevent possible injury to the man loading the magazine.

(1) In the event that the pellets do not move freely into the magazine chamber, check to be sure a broken pellet or a piece of dirt is not causing the balls to jam. Do not force the pellets into the magazine.

j. In loading the magazine, the gun muzzle must be slightly elevated so that the balls will not roll out before the plug has been replaced. Since the pellets are carried from the magazine into the firing chamber by means of a small stream of air, it is necessary that the plug be replaced before attempting to shoot the gun. It is not necessary to apply excessive force in tightening the plug.

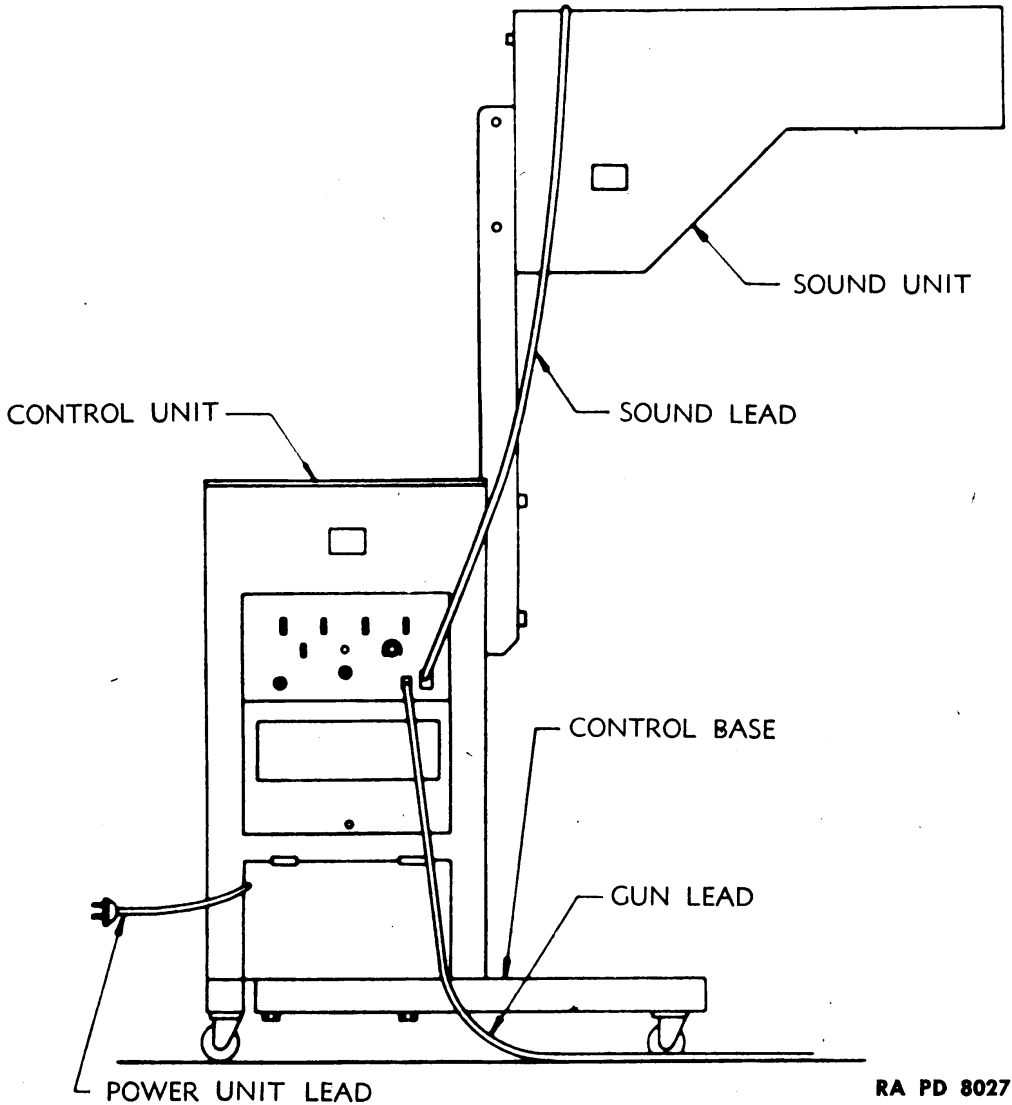
k. The equipment is now ready for final preliminary test. It is assumed that the targets functioned properly when they were installed; therefore, no additional checking should be necessary. Open the air valve between the compressor and the gun. With the switches set as in subparagraph 8 f. above, and with the gun pointed so that it will shoot at the back drop, depress the trigger and note the character of the stream of pellets fired. Assuming that everything is in good working order, the pellets will strike the back drop in approximately the same spot, accompanied by the simulated muzzle blast and recoil for five times as many shots, and suitable battle sounds. Seventy-five percent or more of the pellets will fall within a 6-inch circle at 50 feet, which is comparable in scale to the accuracy encountered with the cal. .50 gun at 500 yards.

9. FINAL INSTRUCTIONS.

a. In operating the target reels, where only one gun is being used and the group is beginning, one man operating the target will be sufficient. It is necessary that the reel operator have the airplane in position at the end of the trolley wire, ready to be towed across the field of fire. It is not important under normal circumstances that the airplane travel in a forward direction to act as a target. This will save the necessity of reeling it back to the initial position after each course is fired. The reel operator must be instructed concerning when he should start the operation of the reel.

b. The muzzle blast sound effect is intended for use along with the recoil effect. If the recoil is cut off, and the gun sound-operated, there may be distortion of the sound due to an internal electrical

OPERATION

**Figure 19 – Control and Sound Unit**

disturbance. This disturbance is normal and will disappear when the recoil effect is produced with the gun sound. If the main switch has been turned to "OFF," the sound effect will not appear at once, if the gun is fired immediately after turning the main switch to "ON." This is because about 4 seconds are required for the speaker coils to build up sufficient energy to operate normally; also the battle sound amplifier tubes must be warm.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section V

DESCRIPTION OF MAJOR COMPONENTS

	Paragraph
Control and sound equipment.....	10
Gun	11
Air compressor	12
Targets	13
Ultraviolet lamp	14

10. CONTROL AND SOUND EQUIPMENT.

NOTE: Any adjustments or replacements described herein, necessitating removal of major parts must be done under supervision of competent personnel.

a. The control and sound equipment (fig. 19) consists of two major parts; the control cabinet and the sound unit cabinet. The control unit cabinet is mounted on a wooden base consisting of two strips of wood attached by means of four carriage bolts. These base strips serve as connection bars to hold the sound cabinet and control cabinet together during shipment. When the sound cabinet is removed by the removal of the two bolts through the extended ends of the base strips, the base members are pivoted on the central bolts connecting them to the control cabinet, so that the ends immediately under the cabinet are pulled together, beneath the center of the cabinet. This causes the two supports to take the form of a "V." The bolts removed from the sound cabinet in uncrating, are then used to connect the base strips in this position to the control cabinet. Two wood uprights are provided to support the sound cabinet above the student's head. These parts are utilized during shipment to tie the top of the control unit and the sound cabinet together. Again, the bolts removed from holding the two uprights to the top of the control cabinet are used for attachment of the uprights to the side of the control unit. Two carriage bolts are used in each support.

b. The sound cabinet is provided with two metal projections that form hooks for supporting it on the uprights (fig. 27). These hooks engage two carriage bolts, which pass through the upper portion of the uprights. When the sound cabinet is hooked in position, nuts are tightened against the hooks to hold the cabinet firmly in position.

c. Figure 3 indicates the appearance of the right side of the control cabinet. This is the portion of the cabinet on which all the controls are concentrated. Centrally located on the upper half of the

DESCRIPTION OF MAJOR COMPONENTS

side wall of the cabinet is the control panel which includes five switches, a volume control, a fuse, and three electrical outlets. Looking directly at the panel, the lower left switch is the main control switch, which controls the power to all parts of each gun and sound assembly, but not the air compressor, when the entire training equipment is assembled. This is the master switch. Nothing, except the compressor, will operate unless it is turned to the "ON" position; there are, however, switches beyond the master switch for the individual control for various elements of the equipment. Above and to the left of the main switch is the firing switch which controls the operation of the electromagnet which fires the gun. On the same level and to the right, are switches to control the recoil effect and the sound that stimulates the gun blast. Next, on the extreme right is the lever switch used to control the shunt to cut the battle sound out of, or into the circuit. Below the main switch and to the left is an outlet to be used as a source of power for the ultraviolet lamp used in night firing. To the right of the main switch and on the same level are located the fuse which protects the speaker units, and the knob for controlling the volume of battle sound. Beneath the fuse in the center of the panel is a pilot light to indicate visually whether or not the main switch is in the "ON" position. At the lower right of the panel are two polarized outlets. The one on the extreme right is to receive the plug from the sound unit. The left one of the two is to receive the plug from the gun. A fuse for protecting the amplifier is located on the amplifier panel.

d. Below the panel is a hinged door which opens into a storage compartment. The power "input" cord attached to the main alternating-current terminals, is stored in the upper left section of the compartment (fig. 20). Any required length of cord up to 75 feet, may be withdrawn in order to connect it to a convenient source of power. Standard 15-ampere wall outlets may be used as a source of power. Each gun and sound unit, and each compressor must be fed from a separate 15-ampere circuit, or its equivalent. A small upper section is provided at the right for spare parts. Beneath the shelf, on which the cord and spare parts are stored, is a compartment provided for the storage of a spare cone for the gun sound speaker.

e. The control cabinet is divided into four major sections. Figure 20 indicates how the cabinet would appear if the right side, where the control panel is mounted, were removed. The upper compartment provides a space for an automatic record changer. The record changer control mechanism is also located here. Immediately beneath the record changer compartment is the equipment for timing the gunfire, the gun recoil, and for producing the muzzle blast. In the compartment next below, is the amplifying equipment which operates in conjunction with the record changer. Beneath the amplifying equipment is the storage compartment previously described.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

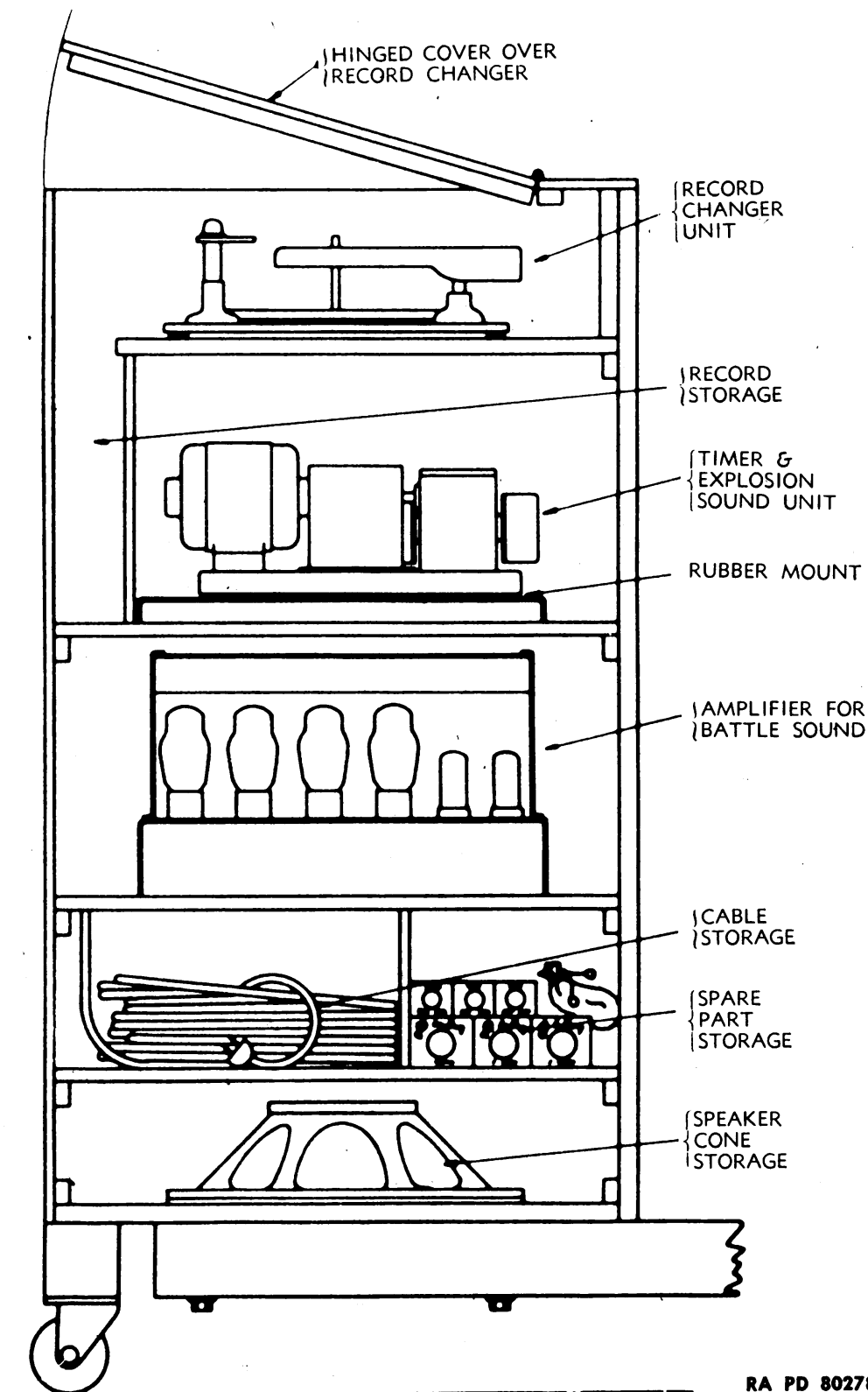


Figure 20 — Control Unit with Panels Removed — Right Side

DESCRIPTION OF MAJOR COMPONENTS

f. Figure 15 illustrates the position of the record selector arms, turntable, and tone arm, with reference to the control. Records are placed on the turntable when the tone arm is raised above and to the right of the table, and the selector arms are set for the correct record size. With the main control switch on the right-hand side of the cabinet snapped to the "ON" position, the player may be put in operation by moving the control knob in the direction indicated for start, that is, toward "REJECT" (fig. 16). The changer will operate continuously until stopped by snapping the main switch to the "OFF" position, or by stopping it by means of the player control. To preserve the life of the record, it is important that the turntable be stopped by means of the player control, which lifts the needle from the record, rather than stopping the table by means of the main switch. To do this, move the changer switch knob toward the position marked "REJECT" and then to "OFF." The mechanism will automatically lift the tone arm away from the record, carry it to right, and then stop.

g. The record changer turntable in the control unit operates at 78 revolutions per minute, and can be used for playing standard records of various types as well as the special battle and sound records.

h. The mechanism involved in originating the explosion sound is shown in figure 21. This unit consists of a motor-driven timing device for timing the interval of operation of the firing pin, recoil mechanism, and the muzzle blast sound. The explosion sound is produced by a timed electrical discharge through a 12-microfarad condenser.

i. The timing device consists of a gear box for producing the correct speeds required for each simulated action (fig. 22). Viewed from the front, the breaker on the rear left-hand side controls the timing of the recoil. The breaker on the right side controls the muzzle blast sound, and the right front breaker controls the rate of firing pellets. Each of these control devices is a cam-operated electrical contact, equipped with a dust cap held on by a spring clip (fig. 23).

j. The electrical contacts are identical in each case, except that the complete set involved both left-hand and right-hand assemblies. The breaker assembly on the firing and gun sound cams are assembled right-hand; whereas the breaker assembly for the recoil cam is left-handed (fig. 24). The cams are pinned to their respective shafts so as to be in definite relation to the flat on the drive shaft. The breaker assemblies are first set roughly in position and then adjusted while the machine is in operation. Details of this adjustment process are covered in section VI and A, figure 25 and B, figure 25. Breaker assemblies are held in position by two set screws each.

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

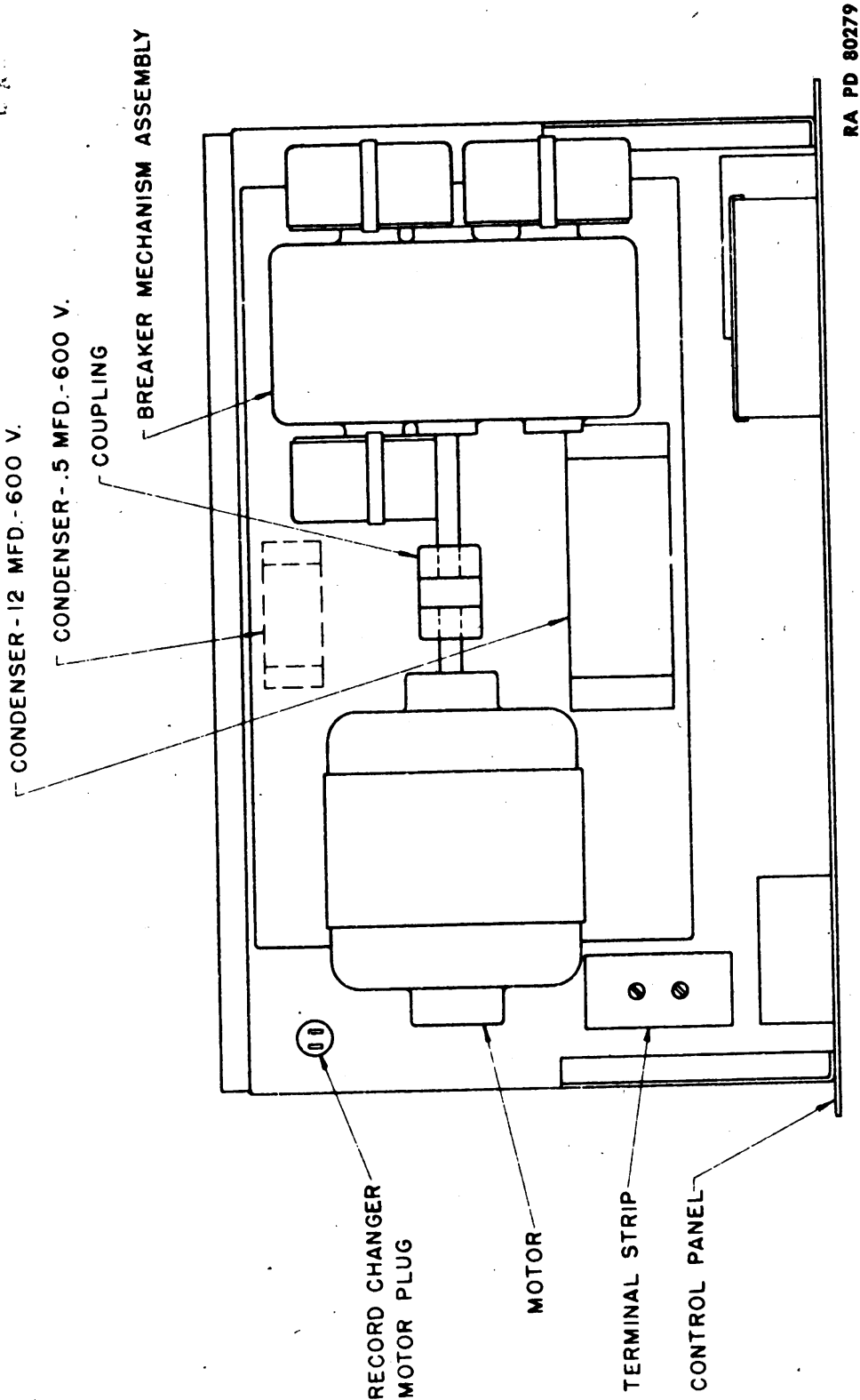
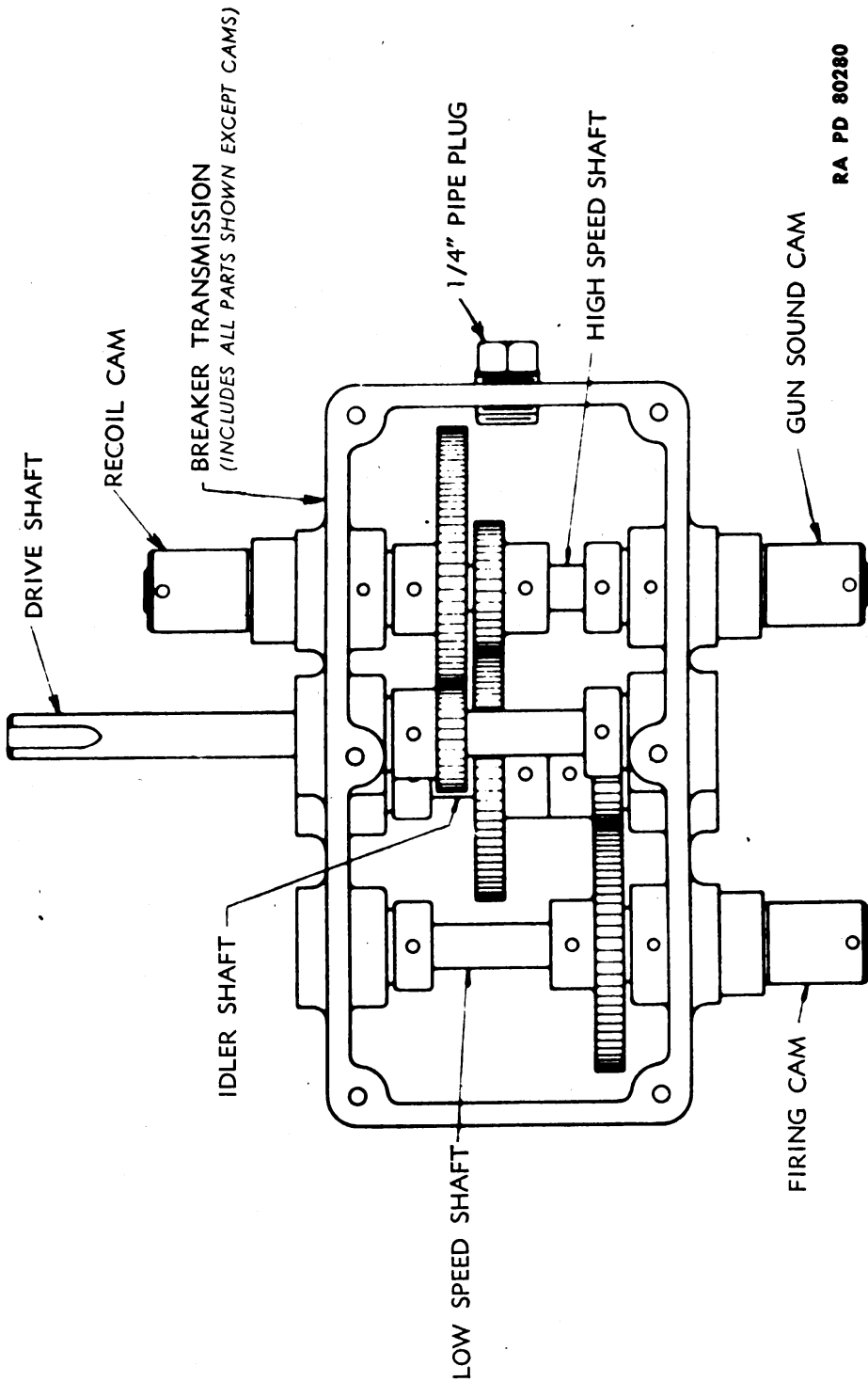


Figure 21 — Timer and Explosion Sound Unit

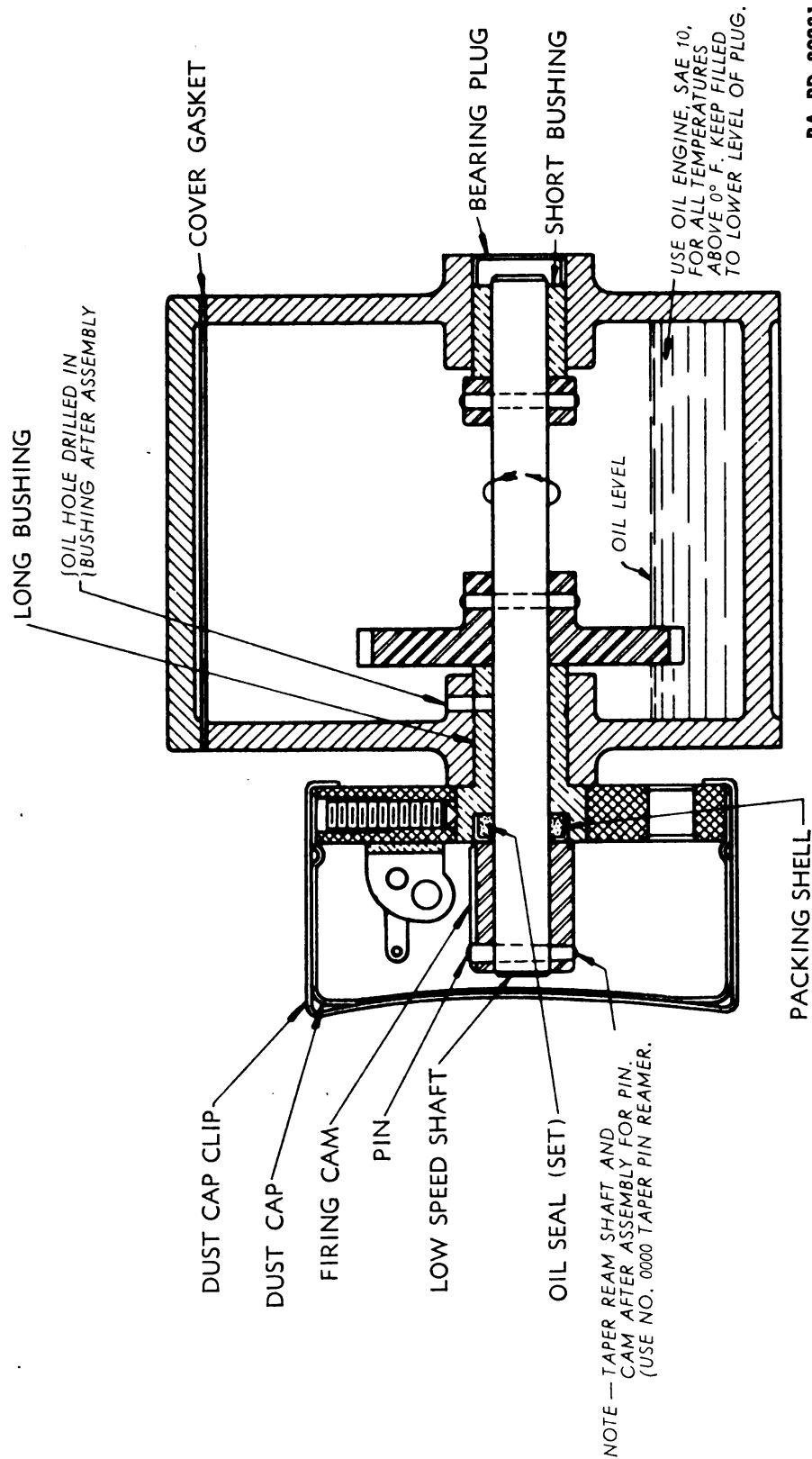
DESCRIPTION OF MAJOR COMPONENTS



RA PD 80280

Figure 22 — Breaker Transmission with Cover Removed to Show Arrangement of Gears — Plan View

ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80281

Figure 23 — Section Through Breaker Transmission

DESCRIPTION OF MAJOR COMPONENTS

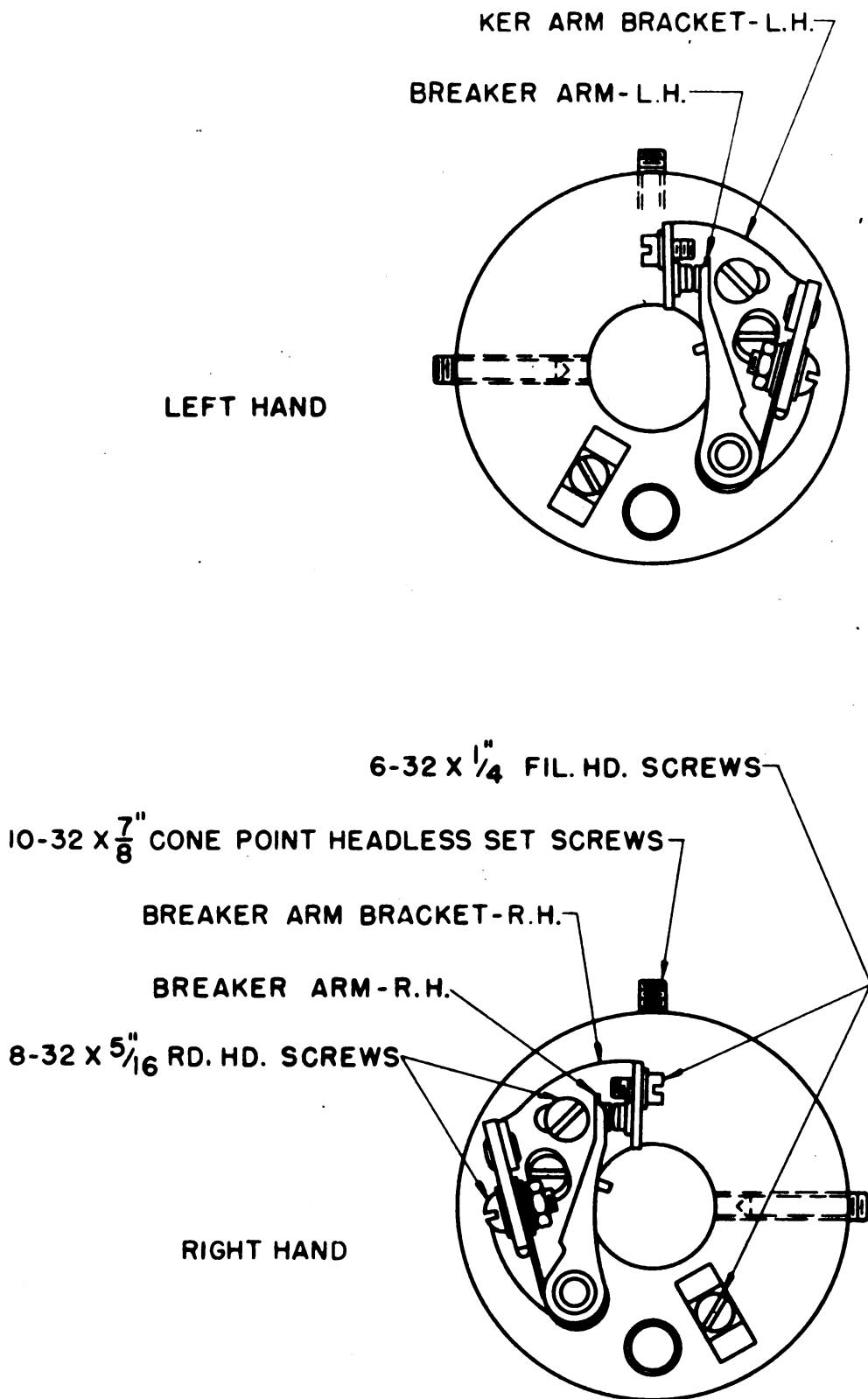
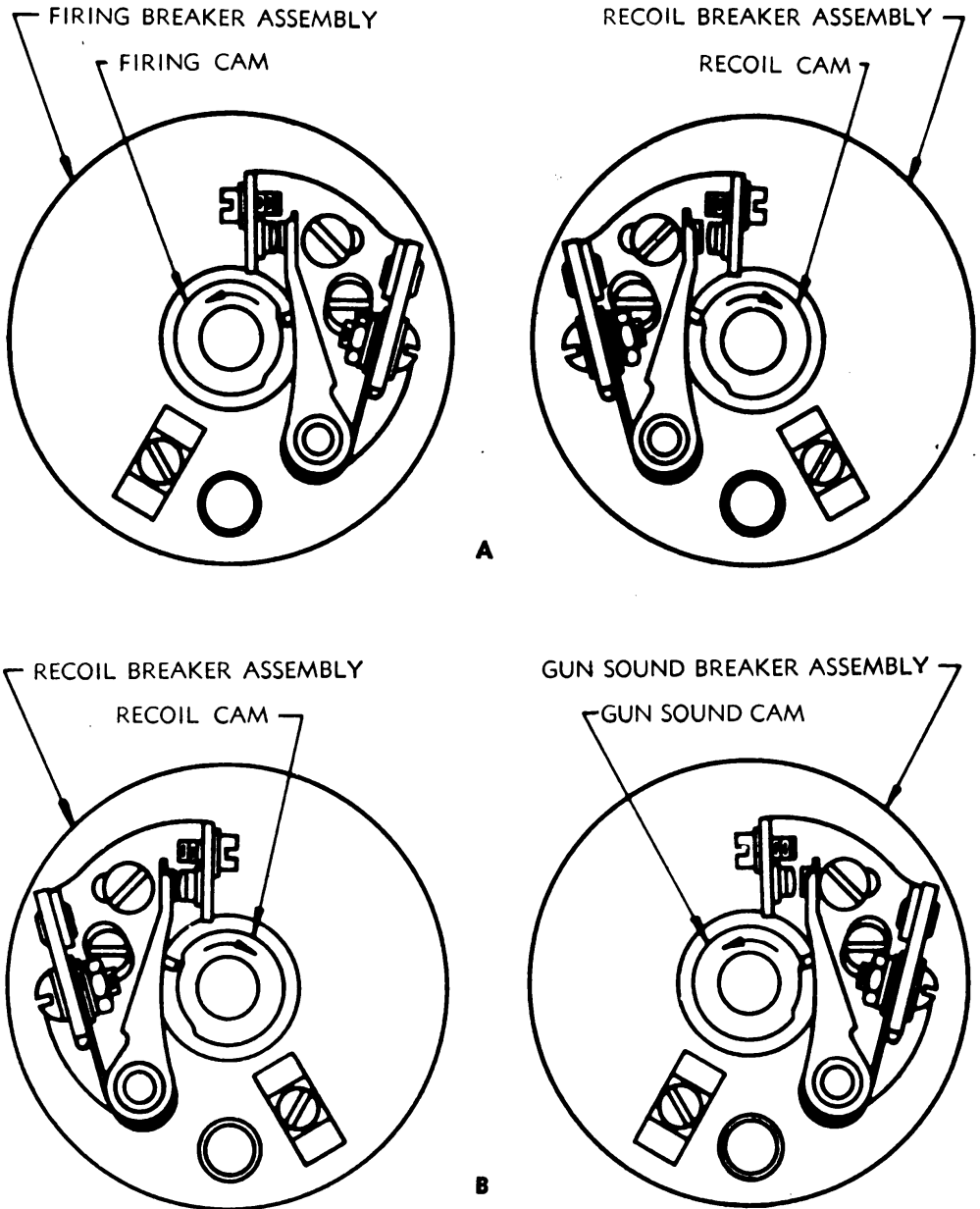


Figure 24 — Breaker Contact Assembly

RA PD 80282

ANTIAIRCRAFT MACHINE GUN TRAINER M9



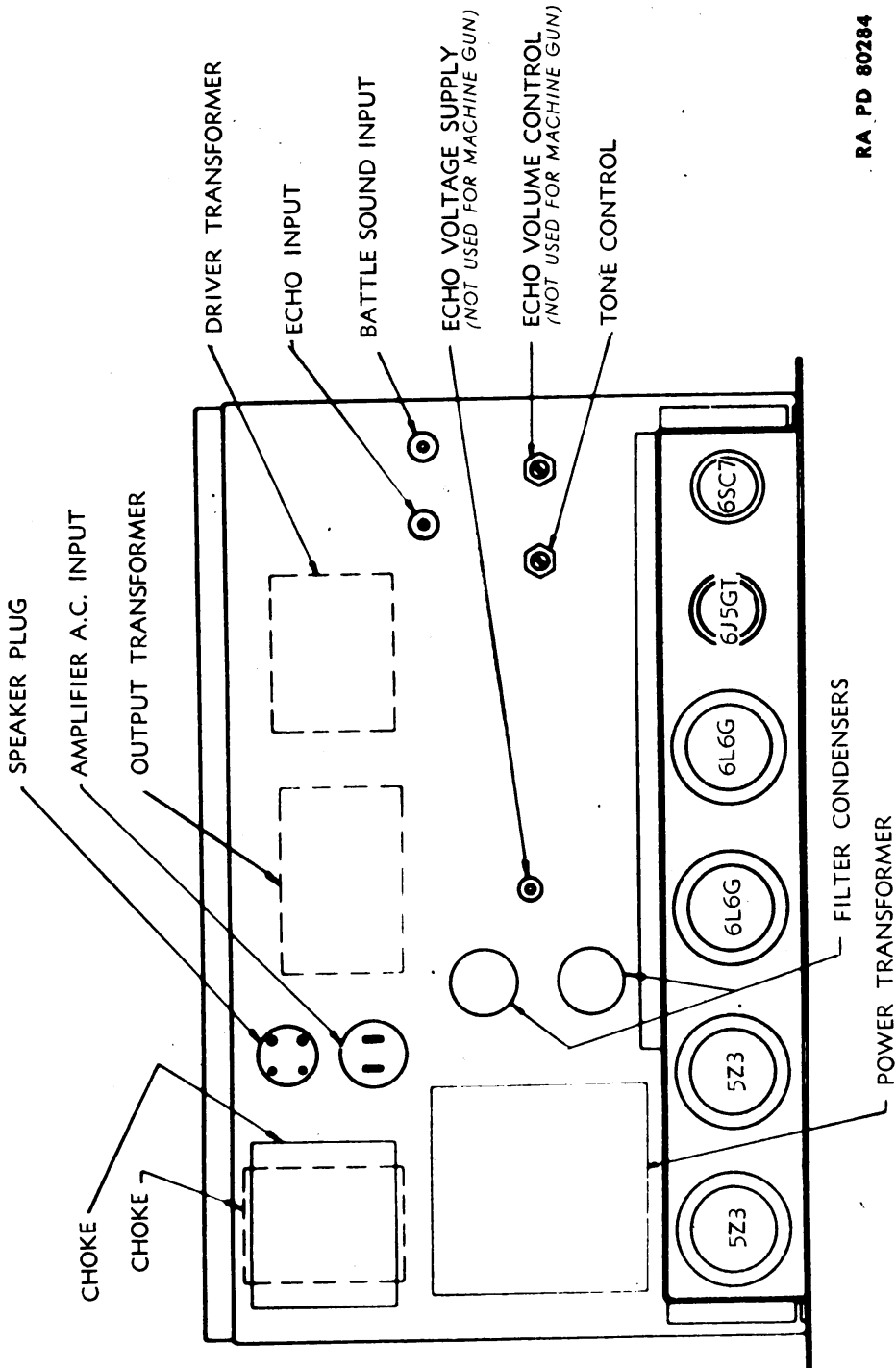
RA PD 80283

Figure 25 — Breaker Assembly Adjustment on Breaker Transmission

k. A plugged $\frac{1}{4}$ -inch opening in the end of the gear box provides an overflow level for the oil used in the gears. No other lubrication is necessary on the mechanism, except lubrication of the motor bearings, approximately once in 6 months.

l. The amplifier unit located in the compartment immediately above the storage section is of the usual 6-tube type. Catalog numbers of the tubes utilized are shown in figure 26. The only volume control for the amplifier unit is mounted on the control panel on the outside of the cabinet. The main switch, on the outside of the

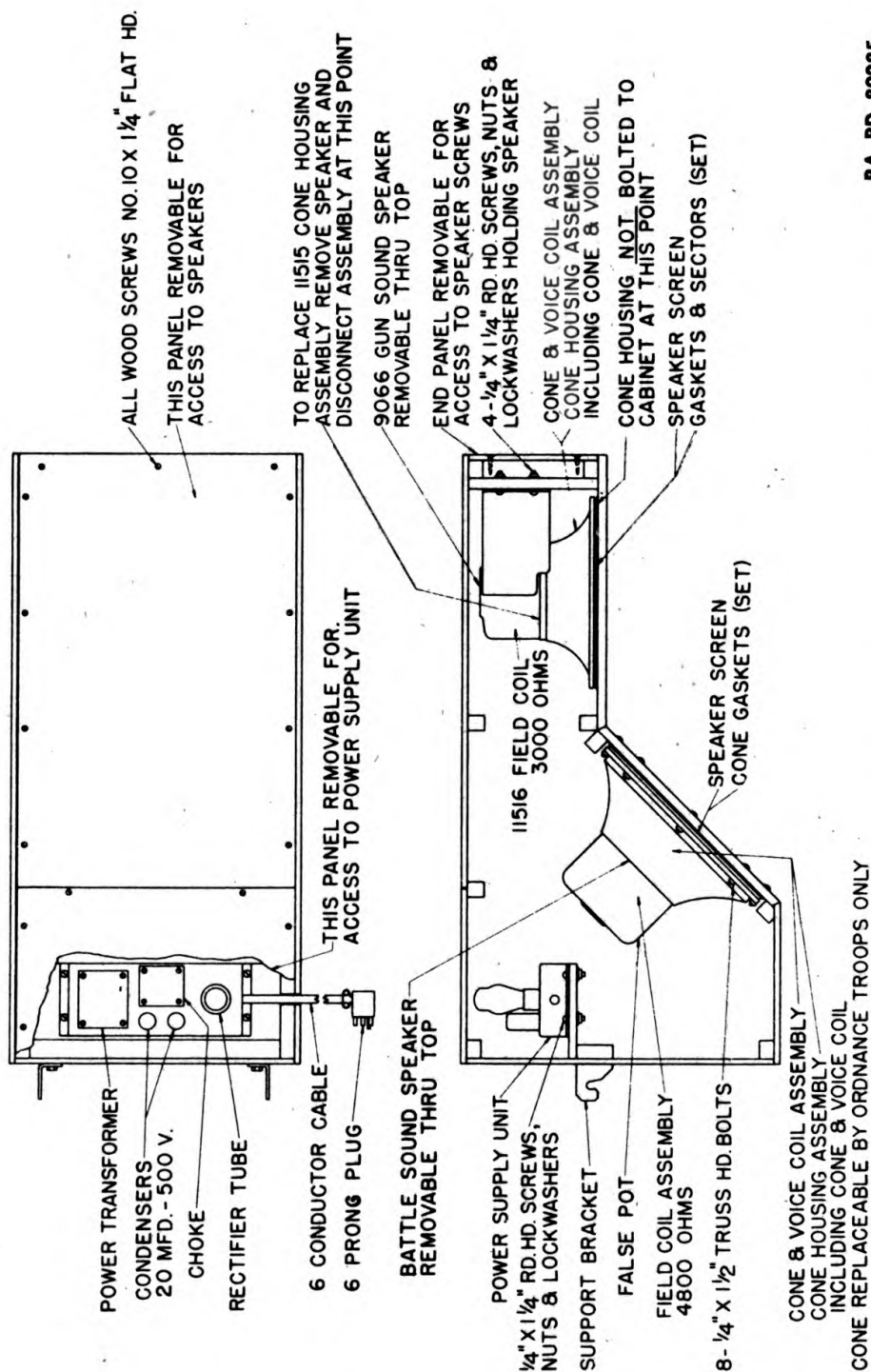
DESCRIPTION OF MAJOR COMPONENTS



RA PD 80284

Figure 26 — Amplifier for Battle Sound

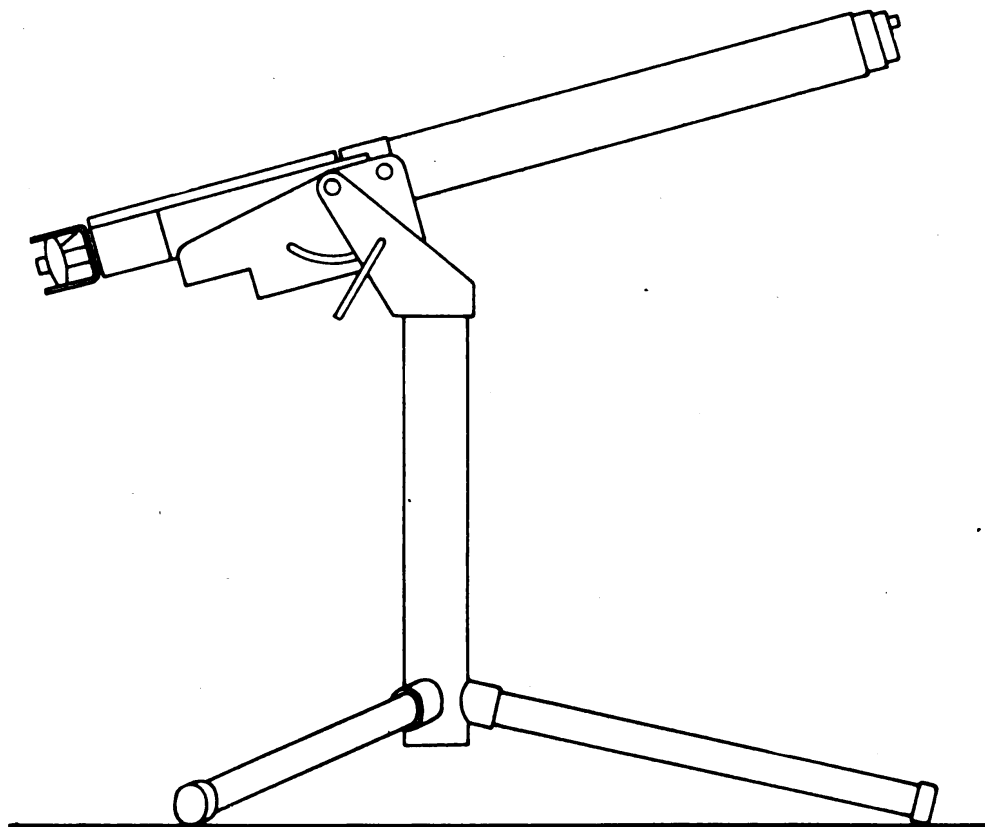
ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80285

Figure 27 — Speaker Cabinet with Side Removed and Top Broken Away

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80286

Figure 28 – Gun

cabinet, functions as a means of starting and stopping the operation of the amplifier. The amplifier unit is intended only for use on 115-volt, 60-cycle, alternating-current circuits.

m. Access to the record changer compartment is obtained by raising the hinged cover on top of the control cabinet (fig. 3).

n. The muzzle blast producing equipment is connected with the auditorium-type speaker mounted in the horizontal section of the sound cabinet (fig. 27). It is held in position by four screws, which connect it to supports attached to the frame work at the front of the cabinet. An auditorium-type speaker is mounted on the angular section of the cabinet for use in conjunction with the record player. These two speakers are not interchangeable and do not have interchangeable internal mechanisms.

NOTE: The muzzle blast sound effect is intended for use along with the recoil effect. If the recoil is cut off while the gun sound is left on, there may be a distortion of the sound due to electrical disturbances set up. These disturbances are normal and will disappear when the recoil effect is produced with the gun sound.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

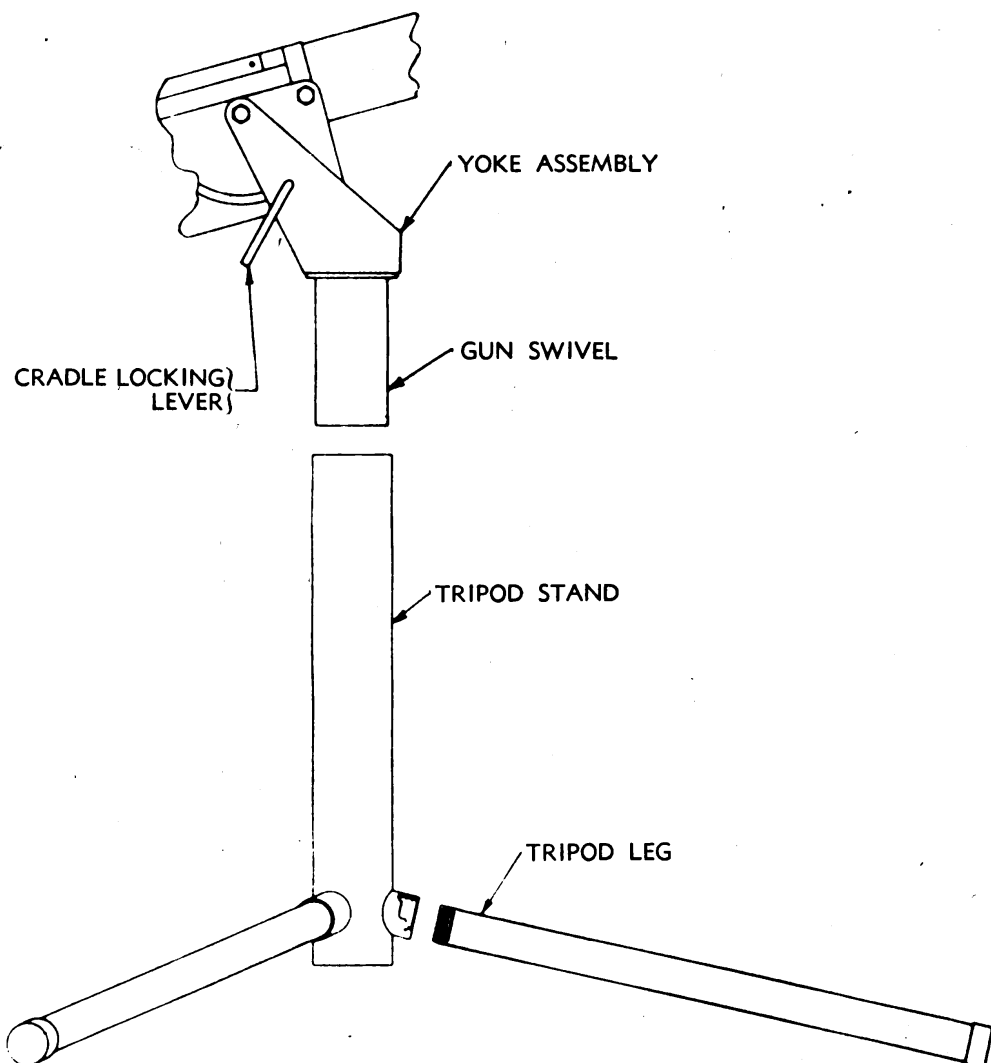


Figure 29 – Tripod

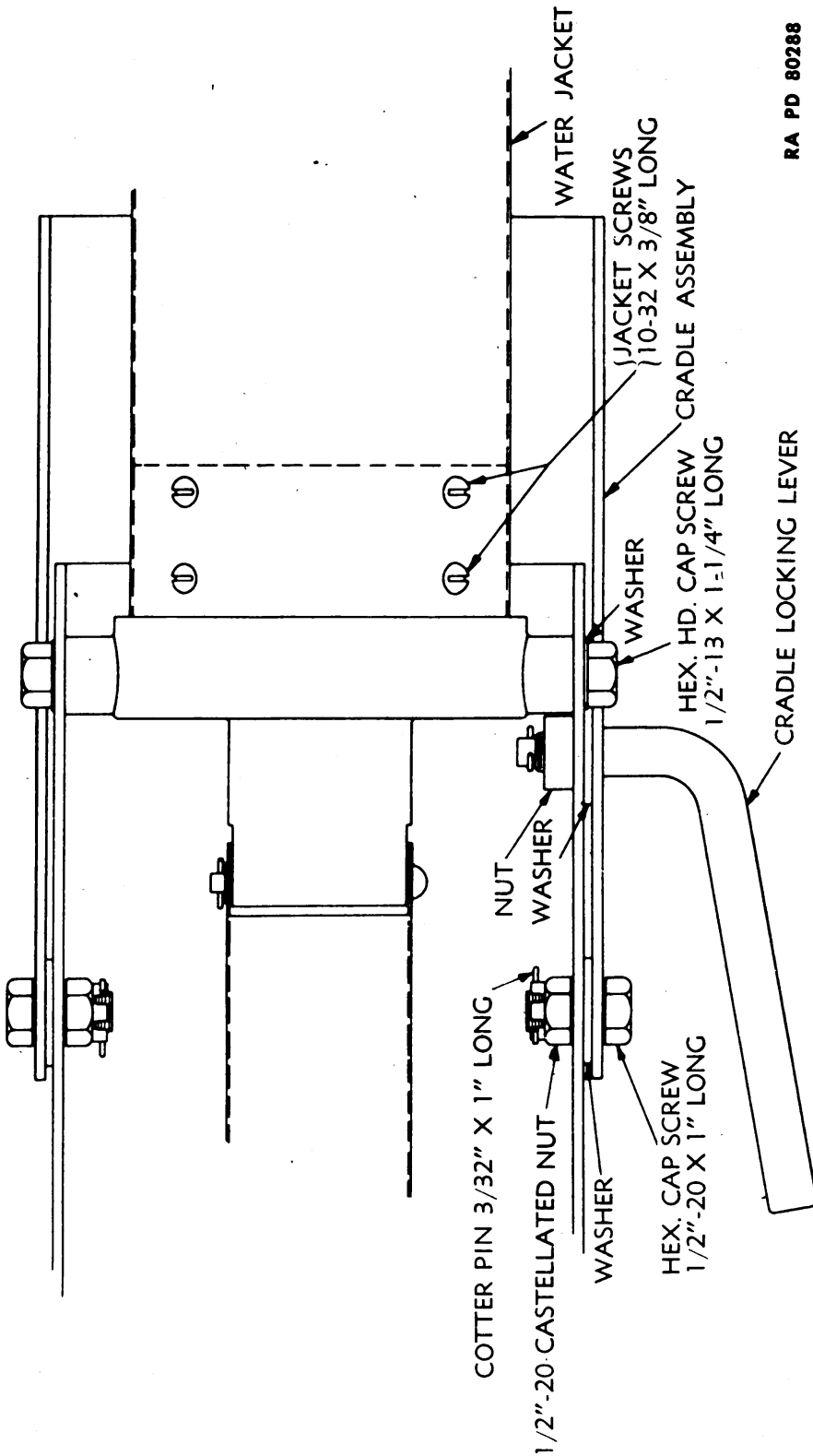
RA PD 80287

11. GUN.

a. The gun portion of the Trainer Assembly M9 is an electrically controlled, pneumatically operated unit, built approximately the same size, weight, and shape as the cal. .50 water-cooled anti-aircraft machine gun (fig. 28). It is designed to shoot $\frac{3}{8}$ -inch diameter plastic pellets at moving targets at a range of 50 feet. At that distance, the gun is designed to simulate actual firing conditions on a 1:30 scale; that is, the trajectory of a pellet on a 50-foot course will be approximately the same as that of a cal. .50 bullet over a 500-yard course. The time of flight of the pellet will be 0.58 second compared to the actual time of flight of 0.62 second.

b. A tubular tripod is provided as a mount for the Trainer M9 (fig. 29). It consists of a vertical pedestal about 6 inches in diameter and 3 feet long, supported on three tubular legs made of 2-inch pipe.

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80288

Figure 30 — Gun Cradle and Swivel

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

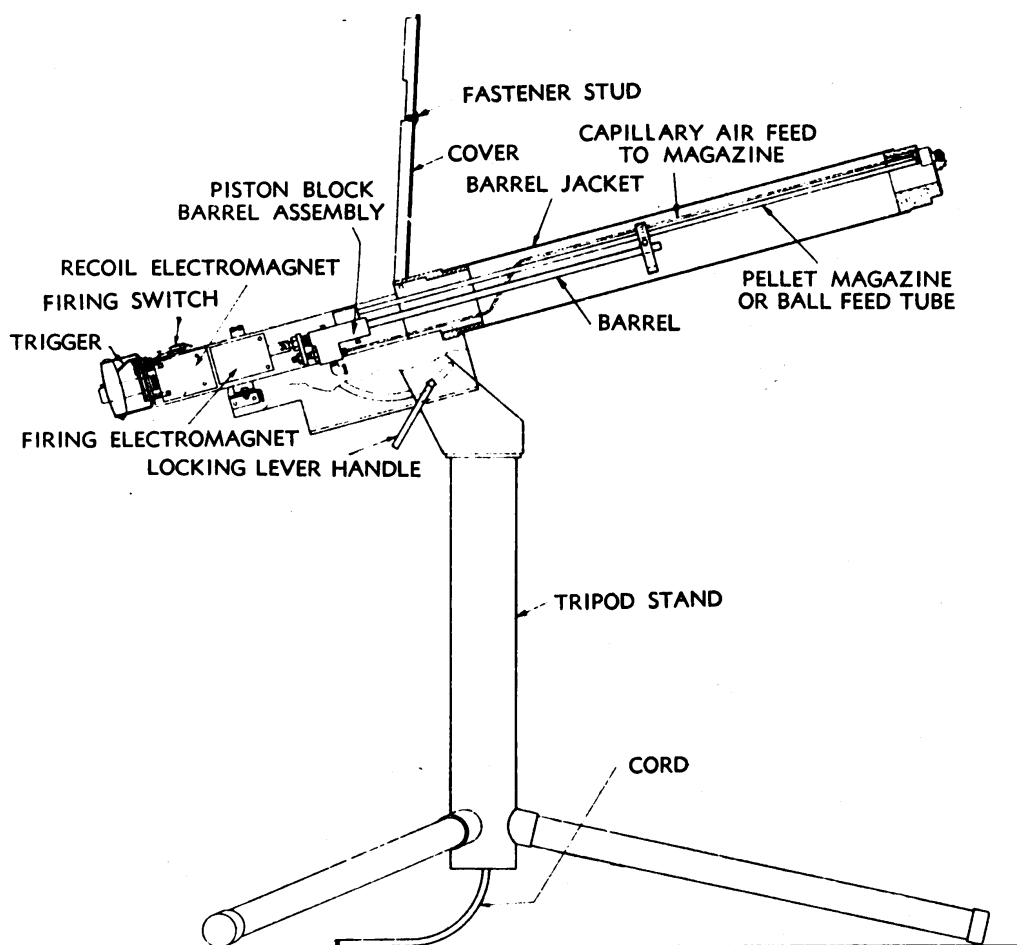


Figure 31 — Section Through Gun

RA PD 80289

c. The gun is mounted in a cradle supported by means of a yoke (fig. 29). The horizontal swivel action is produced by rotation of the tubular section attached to the yoke which fits into the top of the tripod. The cradle provides a vertical, angular, adjustment for the gun, and is equipped with a lever for locking the gun when not in use. There is no lock on the swivel (fig. 30).

d. The gun mechanism includes two electromagnets, one to provide the recoil effect and one to release the pellet to be fired by a blast of air (fig. 31). The firing electromagnet also opens the air valve, permitting the flow of air for forcing the pellets out of the barrel. The tubular barrel extends about half the length of the simulated water jacket. Above the barrel is mounted a tubular magazine for feeding the balls into the firing chamber. A small air tube is connected to the magazine to provide air under pressure to force the pellets into the firing chamber. The amount of air is regulated by a small hole in the connector fitting attached to the piston block

DESCRIPTION OF MAJOR COMPONENTS

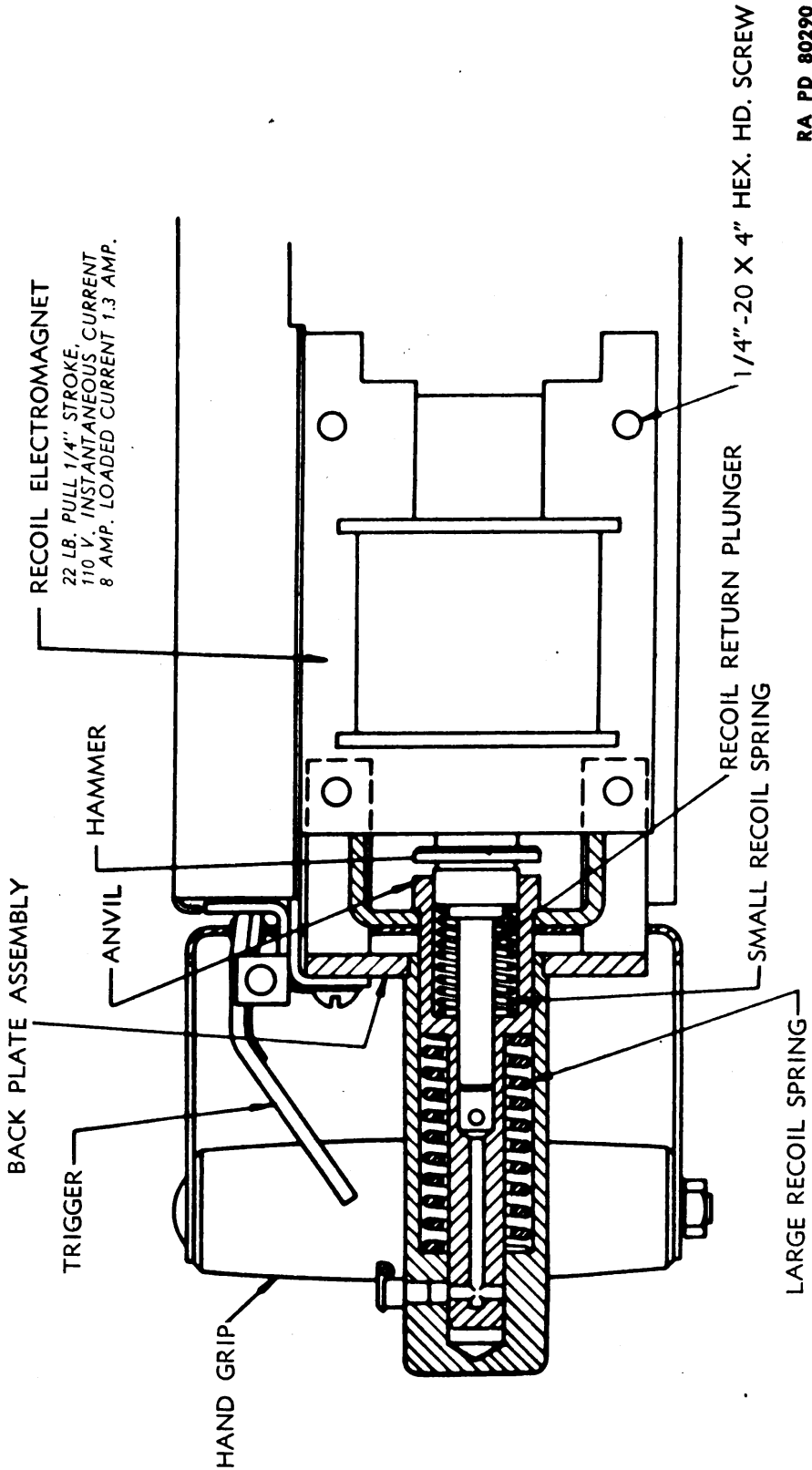


Figure 32 — Recoil Electromagnet

ANTIAIRCRAFT MACHINE GUN TRAINER M9

(fig. 35). The electromagnets and mechanism concerned with the firing chamber are supported between two sheet metal plates and are covered with a hinged cover which is held closed by a screw clamp. To open the cover, turn the clamp screw and lift the cover. It is hinged at the front end.

e. The recoil effect is produced by a magnetic hammer mounted at the trigger end of the gun (fig. 32). The sheet metal bracket which supports the wood hand grips is not attached to the main gun body, but rather to a floating member, which is free to slide horizontally, parallel to the center line of the gun. The handle assembly is held in the forward position by means of a heavy spring. A light spring returns the magnetic hammer to its starting position. The hammer moves a short distance and gains momentum before it strikes the anvil. When the hammer contacts the anvil, the anvil unit is moved rearward against the heavier spring and imparts the recoil effect to the handles.

f. The electromagnet used in this assembly develops a striking force of approximately 22 pounds with $\frac{1}{4}$ -inch stroke. The instantaneous rating of the coil is 8 amperes at 100 volts. The average operating current will, of course, be somewhat less.

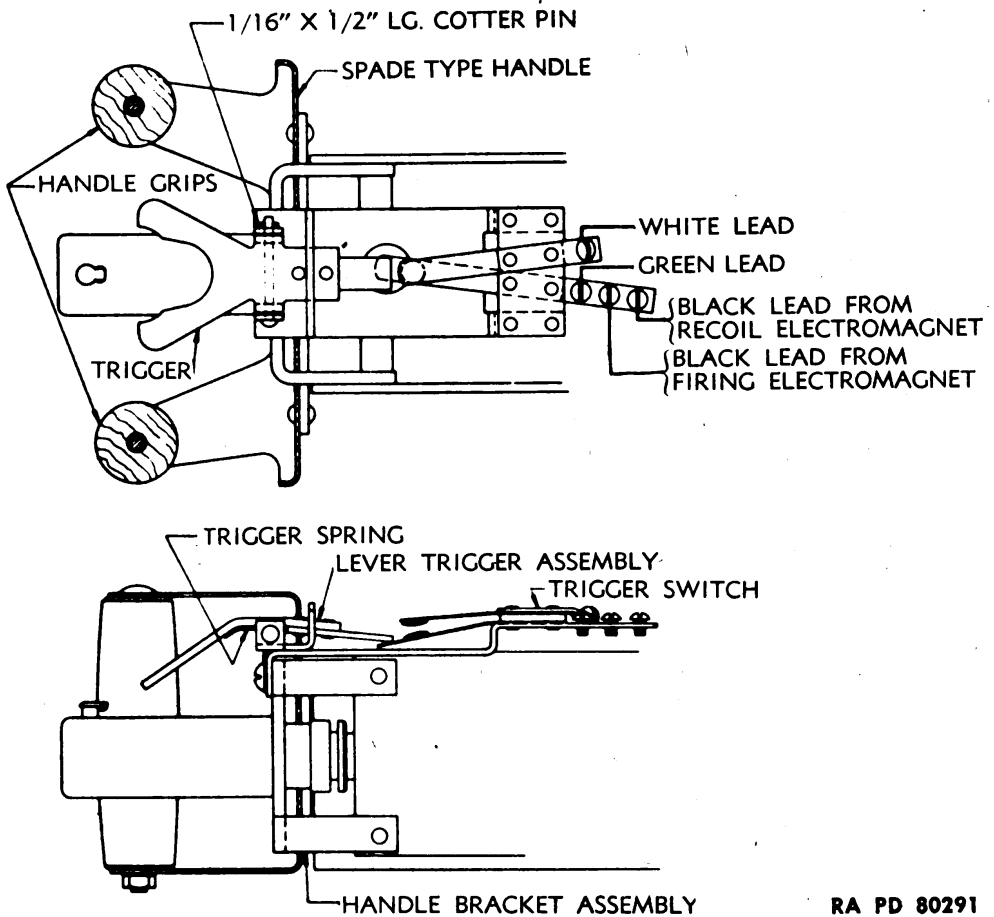
g. A butterfly-type trigger is mounted between the hand grips (fig. 33). When the trigger is depressed, it permits the silver contacts on the leaf spring to close, thus completing the circuit through the timing mechanism to the various elements of the gun. A return spring on the trigger returns the trigger to the starting position when it is released, and permits the contact springs to open the circuit.

CAUTION: The trigger should be fully depressed, or it will jiggle the switch on and off and cause erratic firing.

h. The electromagnet for actuating the firing mechanism is mounted immediately in front of the recoil electromagnet (fig. 34). It produces a force of about 8 pounds with a $\frac{3}{4}$ -inch stroke. The instantaneous rating is 8 amperes at 100 volts. It will be noted that both the recoil and firing electromagnets are rated at 100 volts whereas the entire mechanism is rated for 110 volts. This was done to provide some flexibility so that a small line voltage drop would not render the electromagnets inoperative. The firing electromagnet is directly connected to a plunger piston which moves forward into the firing chamber as the electromagnet is energized. As it moves forward, it compresses a spring, which returns it each time the current is disconnected by the timing mechanism. An adjustable arm is attached to the side of the firing piston near the junction with the electromagnet to actuate the air valve. The space between the bolt attached to the arm, and the air valve plunger should be $1\frac{1}{16}$ inch (fig. 35).

i. The air valve is mounted immediately below the firing pin in the block which constitutes the firing chamber (fig. 35). As pellets

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80291

Figure 33 — Firing Switch

are fed into the barrel from the magazine, they are prevented from rolling out by means of a retaining pin. The retaining pin is attached to a detent lever mounted below the firing chamber. As the firing pin moves forward, it engages a detent spring actuating pin, which forces the lever and spring downward, moving the retaining pin from in front of the pellet. As the firing piston continues in its forward path, it starts the ball in motion and by means of the side arm opens the air valve. At the same time, a series of side ports which communicate with the central opening in the firing piston are in line with the air passage through the air valve. This permits a stream of air to flow from the air hose up through the valve, the firing piston, and against the ball to be shot from the barrel as in figure 36. The blast of air propels the ball out to the target at the required speed

j. The external appearance of the gun, which causes it to be identified as a water-cooled gun, is produced by a sheet metal jacket mounted around the barrel and magazine (figs. 31 and 37). It is attached at the firing chamber by means of eight screws. A wood

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

RA PD 80292

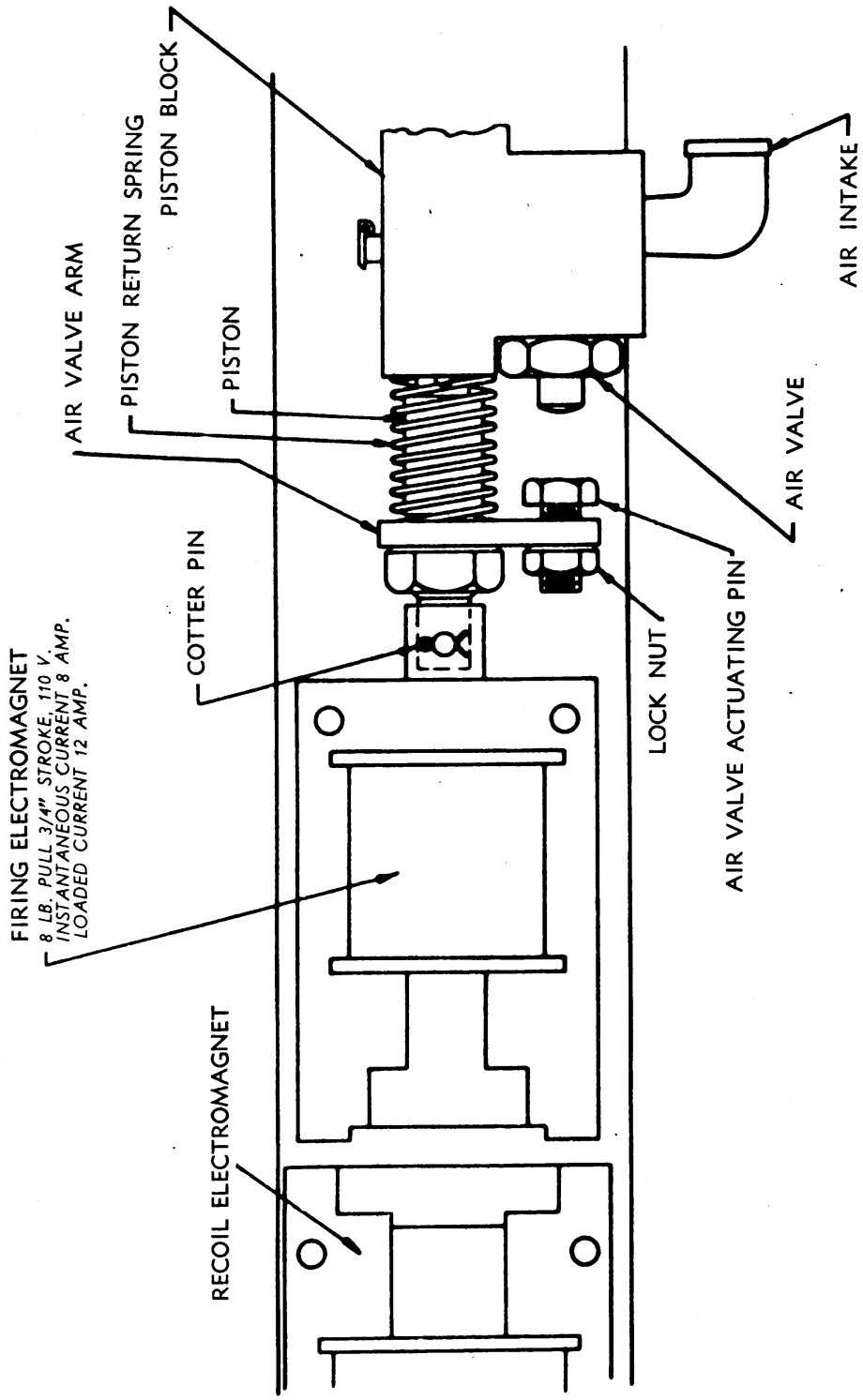
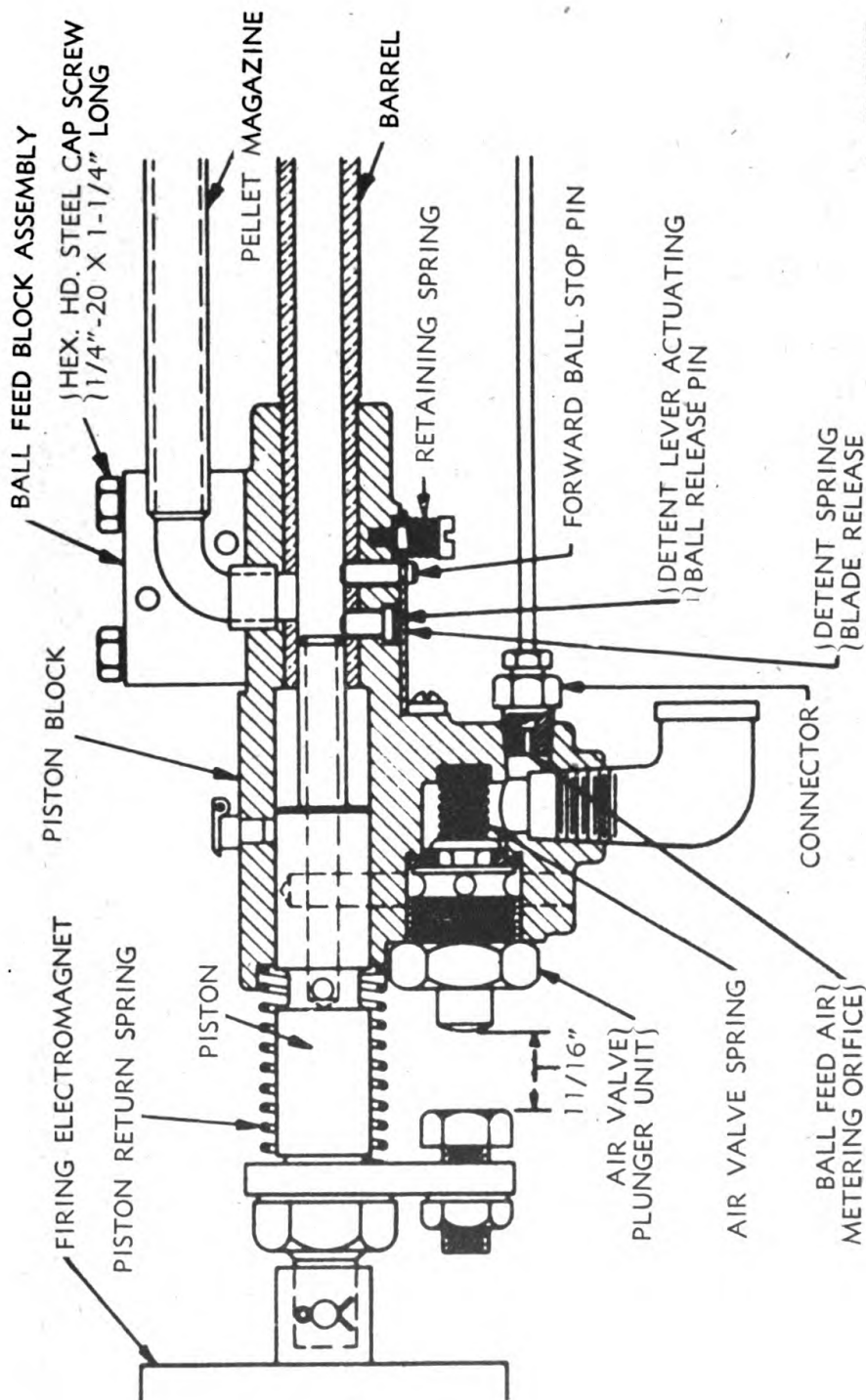


Figure 34 — Firing Electromagnet and Firing Pin

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80293

Figure 35 — Feed from Magazine to Barrel

ANTIAIRCRAFT MACHINE GUN TRAINER M9

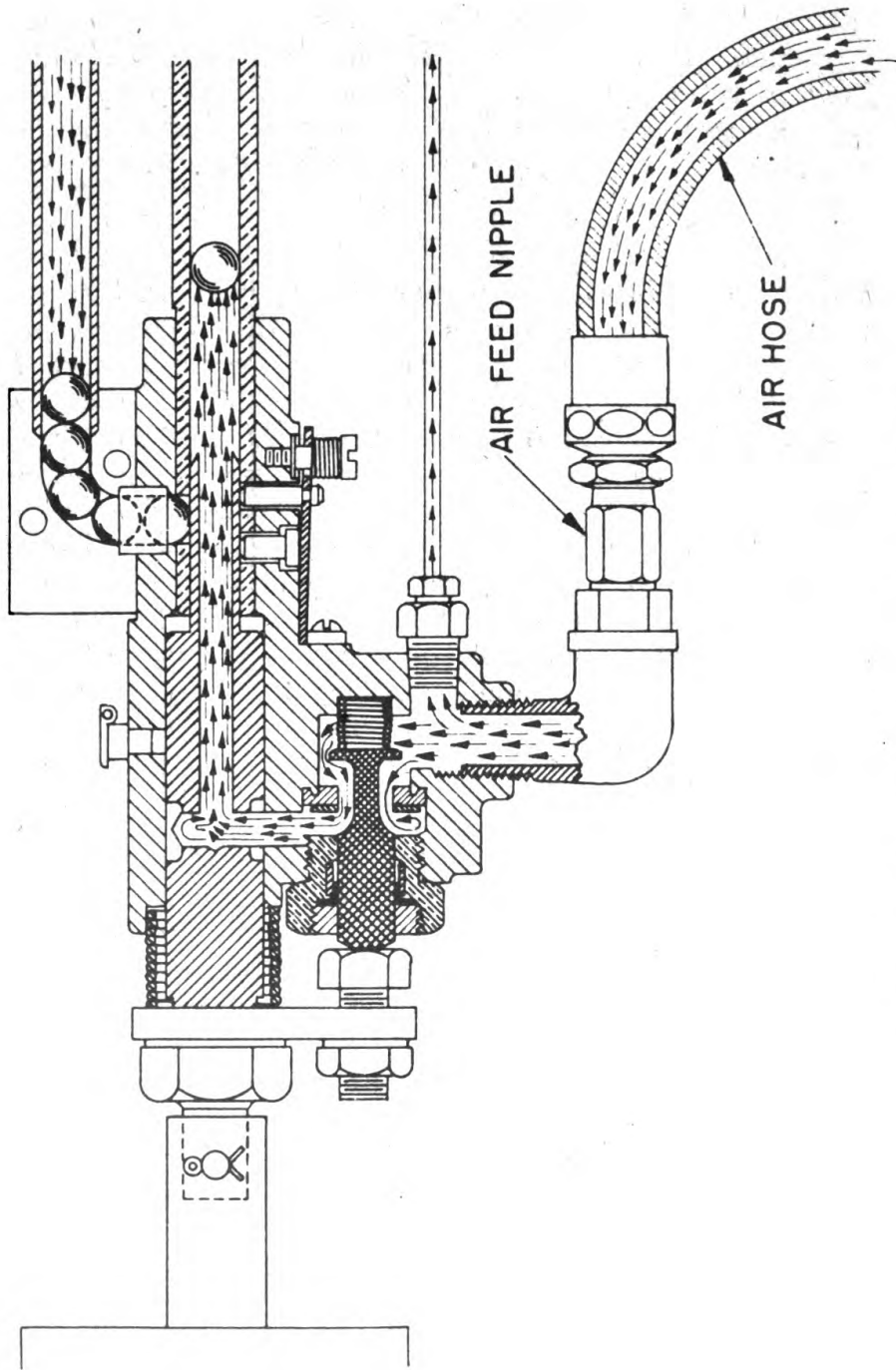


Figure 36 — Path of Air Stream in Ejecting Pellet

RA PD 80294

DESCRIPTION OF MAJOR COMPONENTS

end plug is provided to simulate the appearance of the muzzle of the water-cooled gun. A hole of sufficient size is provided to permit the pellets to pass from the barrel through the plug, without interference. Immediately above the discharge opening is the plugged opening for loading pellets into the magazine. Attached to the opening is a small air tube, which provides a stream of air to force the pellets through the magazine into the firing chamber regardless of the elevation of the gun muzzle. No valve is provided in the magazine air pressure system; therefore, a small leak of air is detectible whenever the gun is standing idle with the valve on the air hose from the compressor opened.

k. In order to facilitate the loading of pellets into the magazine, a loading tube is provided. A hopper for loading pellets into the tube is mounted on the left-hand side of the control cabinet (fig. 7). The hopper is a tubular device with a cone-shaped bottom. There is a hole in the center of the bottom, slightly larger than the diameter of the pellets. By placing the loading tube under the hopper, the pellets will readily fall into the tube for transfer to the magazine. In order that the pellets will not drop out of the hopper when the loading tube is not in position to receive them, a lever-like catch has been provided as a stop. The broad end of the loading tube pushes the catch out of position when it is held under the hopper. Difficulty is usually encountered when attempting to feed a large number of balls through a small opening in the bottom of such a hopper. To avoid this difficulty, a hand-operated agitator is mounted in the center of the hopper. The procedure then, for filling the loading tube, is to place the tube beneath the hopper with the slot visible and turn the crank until the loading tube is filled.

l. In order to transfer the pellets from the loading tube to the gun magazine, the gun muzzle should first be elevated slightly. This will prevent pellets from rolling out. With the plug removed, the large end of the loading tube is then placed in line with the opening in the magazine, and the slide bolt in the loading tube pushed toward the gun muzzle (fig. 18). In moving the balls in the loading tube into the gun magazine, there sometimes is a tendency for the balls to blow out during the operation. In such cases, it will be necessary for the operator to place his finger over the opening while preparing to replace the plug.

CAUTION: Pellets ejected from the Machine Gun Trainer M9 with the normal air pressure of 20 pounds are discharged with sufficient force to penetrate such material as heavy cardboard. It is, therefore, important that anyone working around the gun muzzle be assured that there is no possibility of the gun being fired. This can best be done by snapping the firing switch on the right-hand side of the control unit to "OFF" whenever anyone is around the gun

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

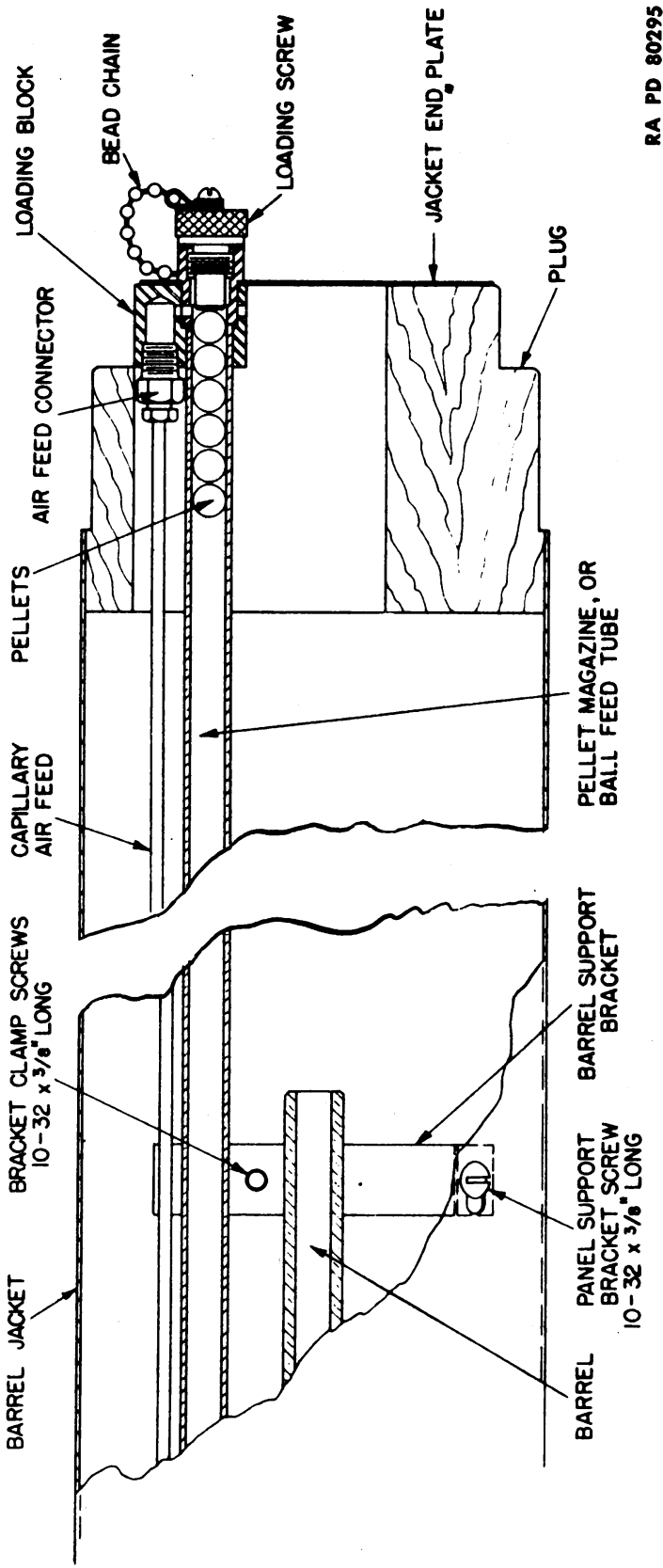


Figure 37 — Loading End of Magazine and End of Barrel

DESCRIPTION OF MAJOR COMPONENTS

RA PD 80296

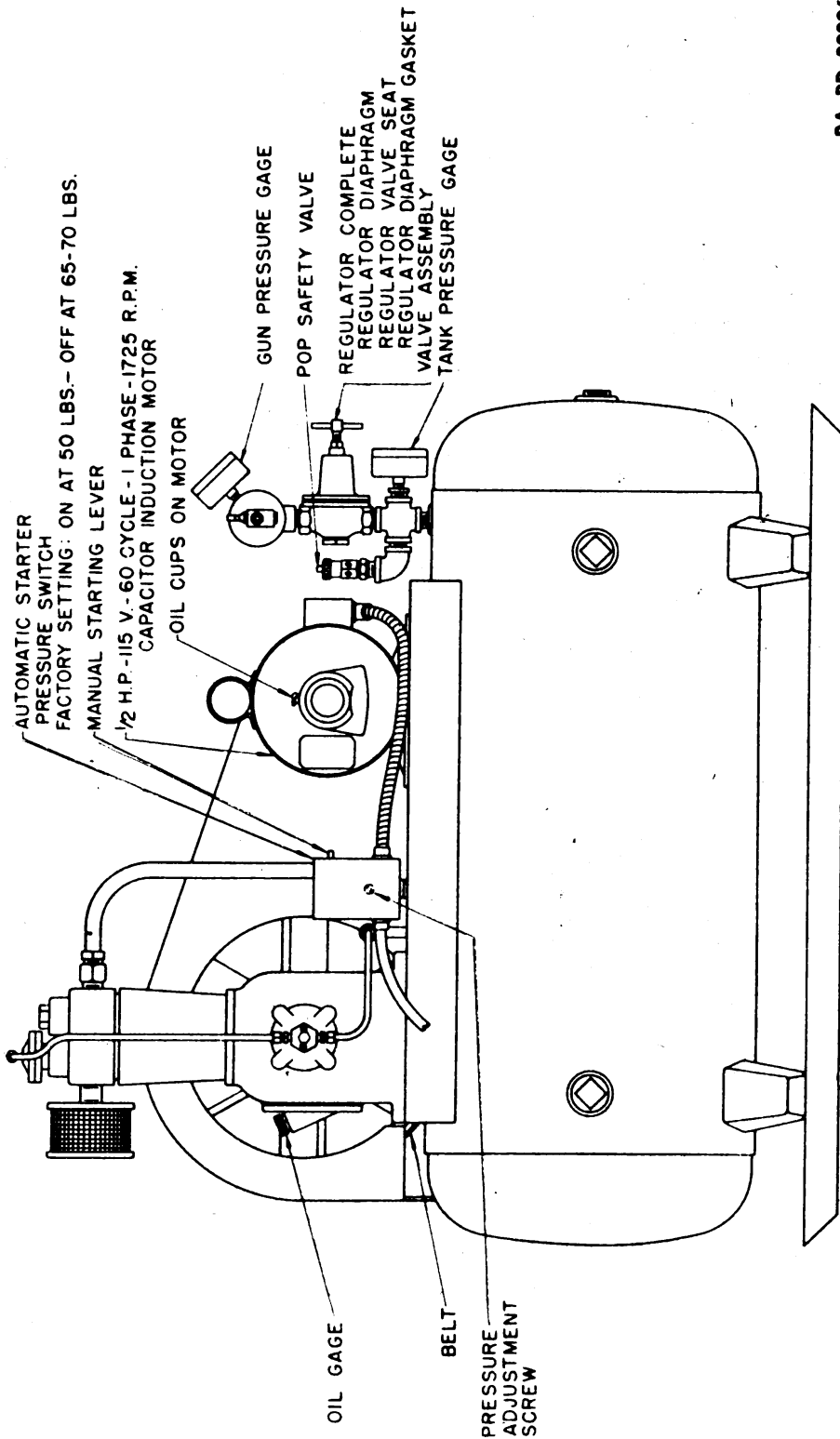


Figure 38 — Compressor

ANTIAIRCRAFT MACHINE GUN TRAINER M9

muzzle. This will prevent firing, if someone accidentally presses the trigger.

12. AIR COMPRESSOR.

a. The air compressor, used as a source of air for propelling the pellets, is of the single cylinder type (fig. 38). It has a capacity of $2\frac{1}{2}$ cubic feet per minute, and is ample for continuous operation of two guns. The compressor is equipped with a fan-type fly wheel, which should run in the direction of the arrow indicated on the wheel, in order to provide proper cooling. It is best not to install the compressor with the fan fly wheel too close to the wall. Wherever possible, the compressor should be installed in a location that is free from excessive dust. It should be supported on a substantial foundation. The driving unit is a $\frac{1}{2}$ -horsepower, 115-volt, 60-cycle capacitor-type motor.

b. The operation of the compressor is controlled by an automatic switch which is set to stop the motor when a pressure of approximately 65 to 70 pounds has been developed in the pressure tank.

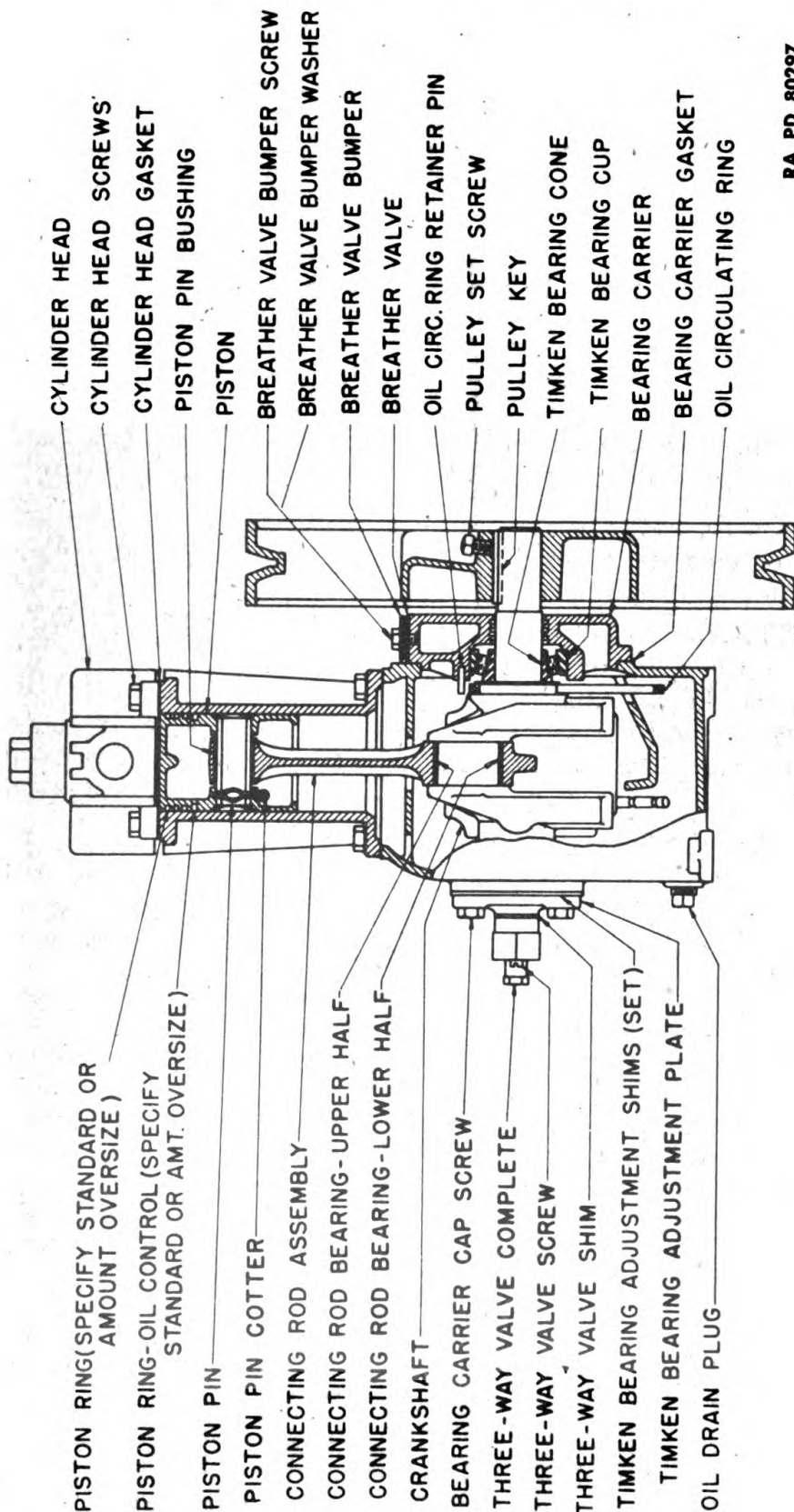
CAUTION: Do not change this setting unless it is to reduce the pressure. Changing to a higher pressure may overload and damage the motor. An adjusting screw for reducing the pressure is located just inside the control box and is reached by removing the cover. In order to reduce the pressure, it is necessary to turn the screw clockwise. A small turn of the screw will make a considerable change in the cut-off point of the automatic switch.

c. Oil should be kept in the compressor crankcase to the "FULL" level mark on the indicator rod (fig. 38). If for any reason, it should fall below the "LOW" mark, add oil to the "FULL" mark.

d. A small equalizing chamber is mounted on the discharge end of the compressor between the compressor tank and the gun valve (fig. 14). The chamber increases the uniformity of the air supply pressure to the guns, thereby improving their efficiency and accuracy. An adjustable, pressure-regulating valve is provided to control the pressure to the guns automatically. The control valve should be set for 20 pounds pressure. This pressure has been found to produce the correct time of flight of the machine gun pellet on a 50-foot range. Changing the pressure will change the time of flight and, as a result, the similarity between the action of the Trainer M9 and the cal. .50 machine gun will be impaired.

e. On the under side of the compressor tank, opposite the reducing valve, is a small drain valve (fig. 14). This is to permit accumulated water to be blown out of the pressure tank. If the compressor is operated continuously, it is necessary to bleed the tank at this point, about once each day, depending on the humidity.

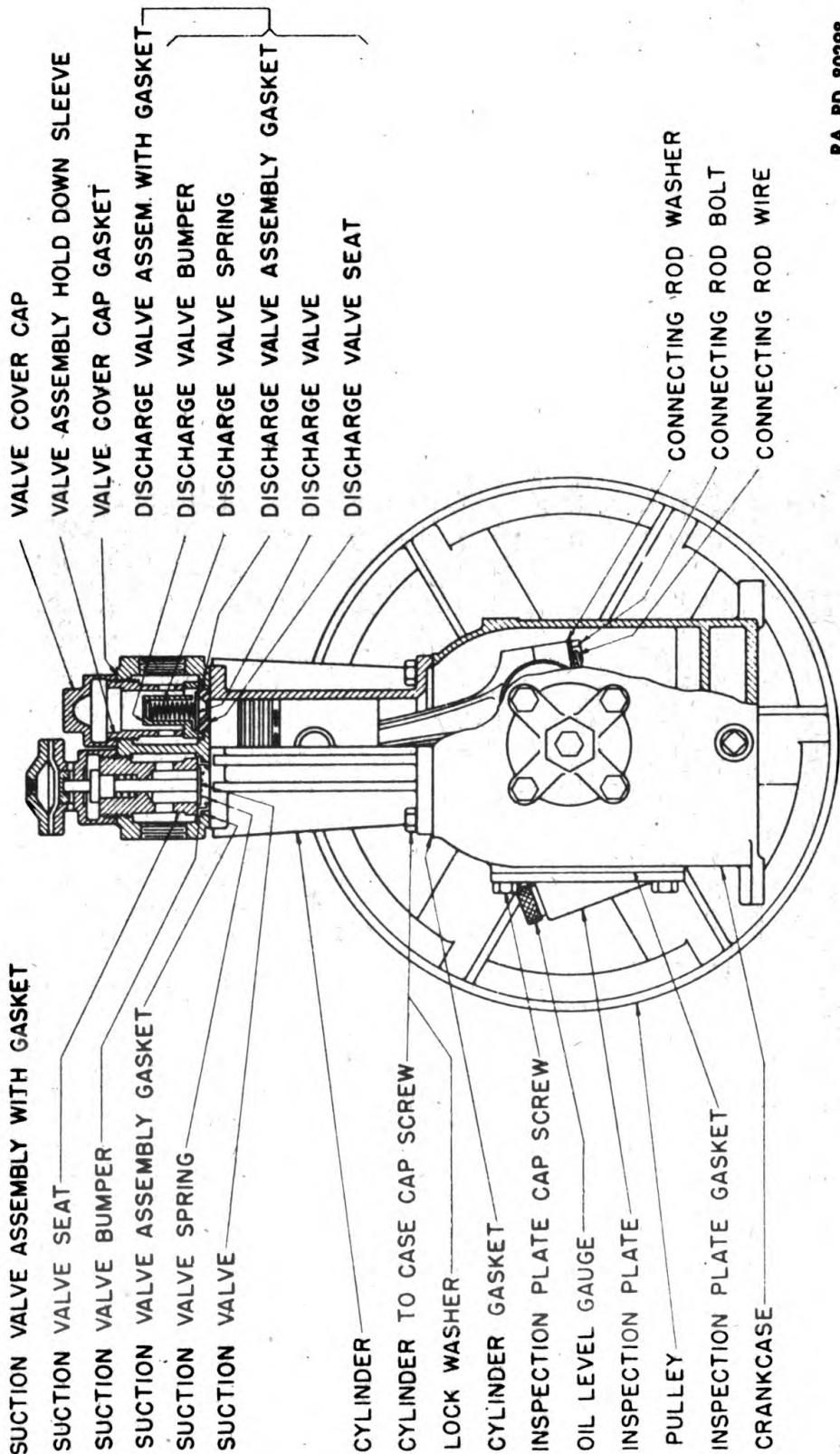
DESCRIPTION OF MAJOR COMPONENTS



RA PD 80297

Figure 39 — Section Through Compressor

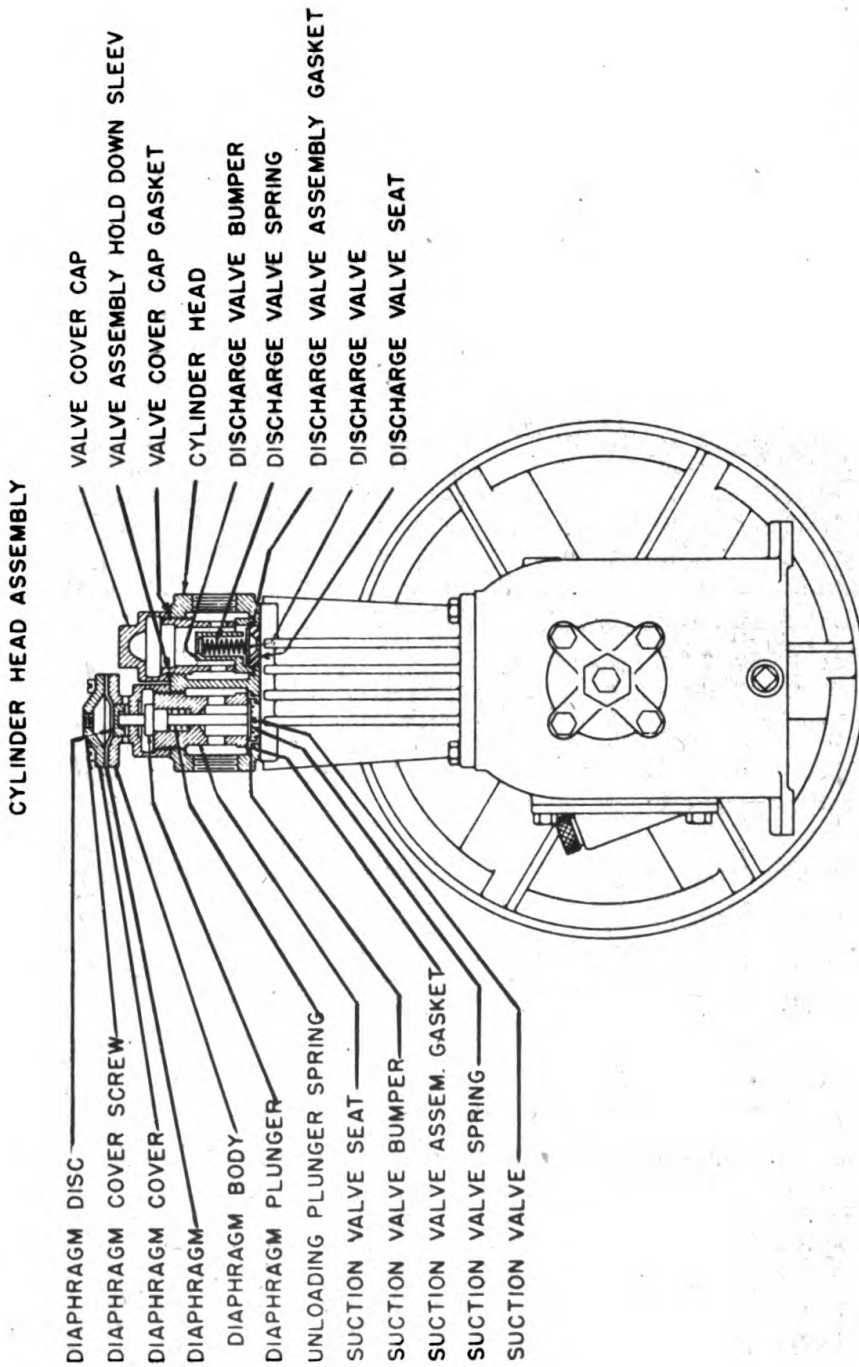
ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80298

Figure 40 — Compressor Suction and Discharge Valves

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80299

Figure 41 — Compressor Cylinder Head Assembly

ANTIAIRCRAFT MACHINE GUN TRAINER M9

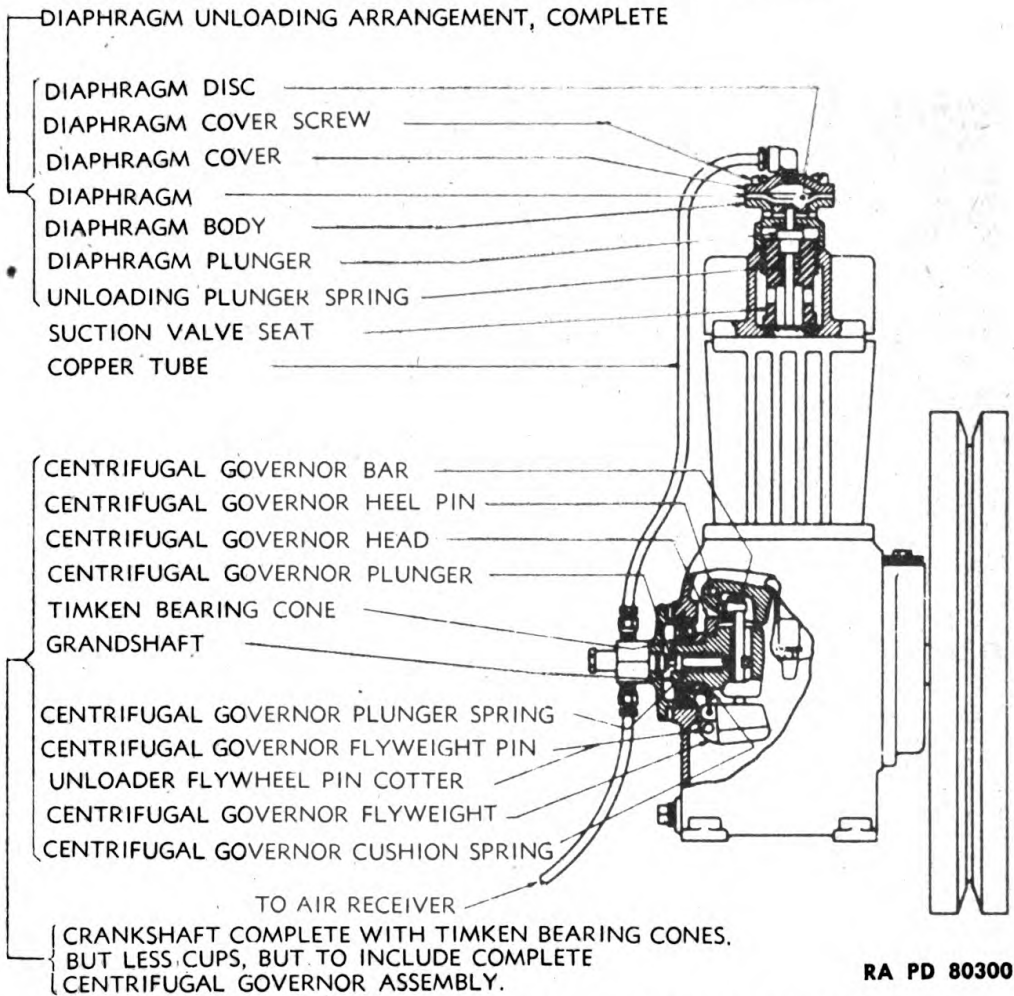


Figure 42 — Diaphragm Unloader and Centrifugal Governor

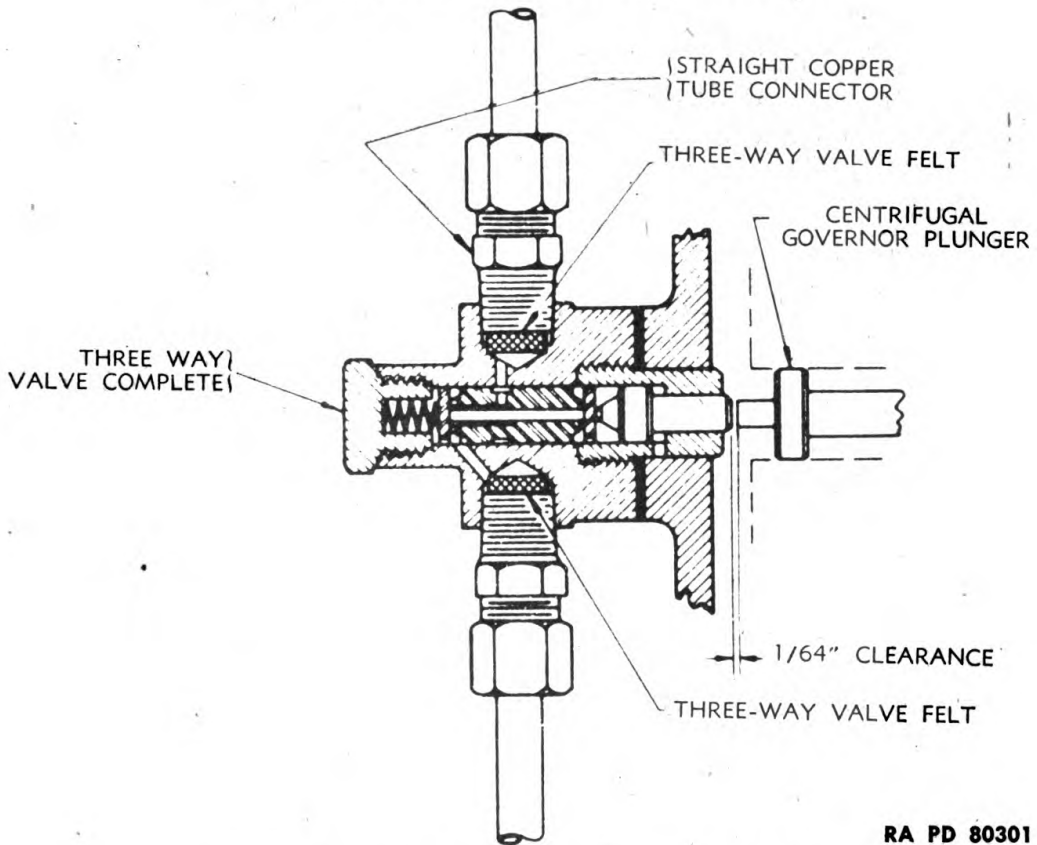
13. TARGETS.

a. Each Trainer M9 includes four small metal planes for use as targets. Because of the rapid change in size of the plane as it passes across the horizon, it is quite difficult to provide a target which will be true to scale on a 1:30 basis, at all positions in the field of fire. On this account, the planes used were selected as being somewhat of a compromise, but of a size which seemed to be desirable. The wing span is approximately 8 inches.

b. Three of the planes are intended for use in daylight. These bear the insignias of the United States, Germany, and Japan. The fourth plane, which is without insignia, is intended for night operation.

c. In utilizing miniature planes as targets, it is desirable to simulate actual flight conditions with reference to the gunner as nearly as possible. For preliminary training, it has seemed desirable to keep the target assembly simple and yet give the gunner a variety of conditions to meet. It is proposed that the three planes be oper-

DESCRIPTION OF MAJOR COMPONENTS



RA PD 80301

Figure 43 — 3-Way Valve in Running Position

ated on three separate trolley wires; one on a horizontal course, one on a diving course, and one on a climbing course. By changing the position of the gun with reference to the trolley wires, the gunner can obtain experience in firing at the planes on the many courses. By moving the gun to varying angles to the trolley wire, varying types of approach can be produced. The limits of these changes are from a position of 90 degrees to the trolley, to one in which the gun is set at one end of the trolley system. When the gun is at one end of the trolley system, the planes will pass overhead in a climb away from, or a dive at, the gunner. Also, by moving the gun along the trolley, away from the end of the wire, planes can be caused to pass over the gunner from behind.

d. Each plane is equipped with a sheet metal hanger, designed to hang on suitable hooks attached to the plane carriage, mounted on the trolley wire. The plane carriage consists of a framework with two wheels to engage the trolley wire, hooks to support the plane, and eyelets on either end for the attachment of the two ends of the tow line. The carriage is designed to operate in either direction; hence, in order to change the direction in which the plane is mounted on the trolley, it is merely necessary to unhook it, turn it around, and again catch it in the carriage hooks. Under ordinary circum-

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

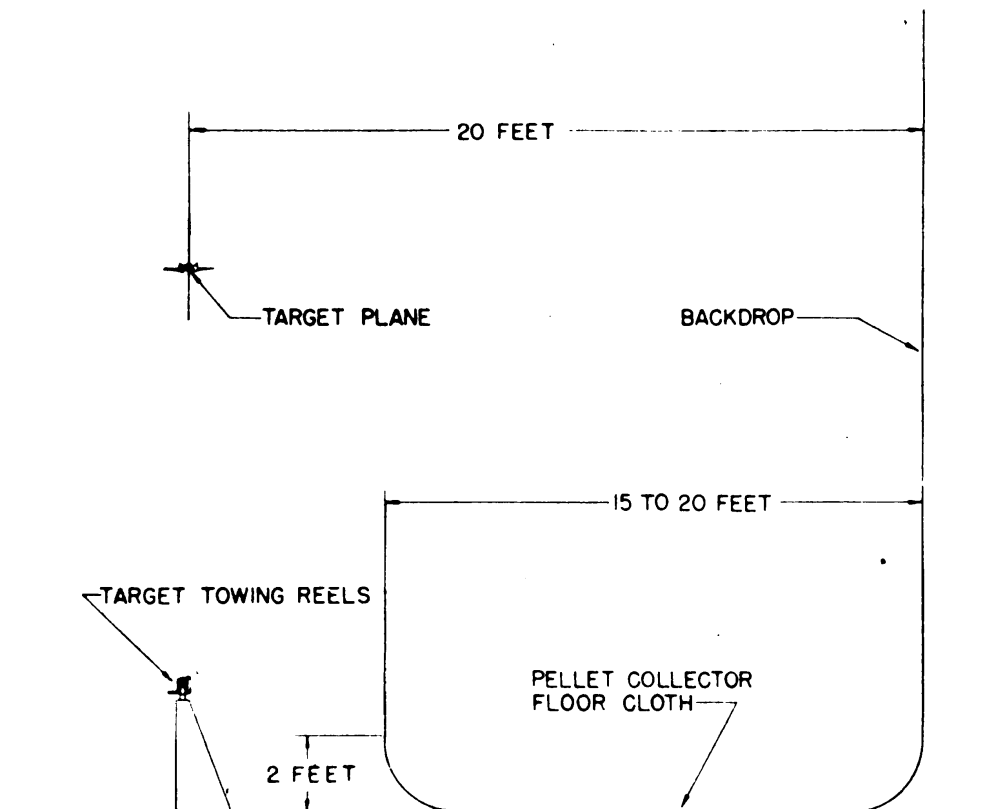


Figure 44 — Target

RA PD 80302

stances, the plane presents as good a target going in one direction as the other; therefore, it is started out in a forward direction, but in operation, little attention need be paid to whether or not the plane is facing the direction of travel.

e. A target reel assembly is furnished with each unit (fig. 4). This assembly consists of a sheet metal base on which are mounted three reels. Each reel is hand-driven. The tow line is carried on a 6-inch diameter pulley. A hand crank is connected to the pulley by means of a gear, which causes the pulley to turn four revolutions for each turn of the hand crank. By this means, it is possible for the operator of the target to tow the target planes at equivalent speeds up to approximately 400 miles per hour. Since the usual speed of a towed target is in the neighborhood of 125 to 150 miles per hour, the speed possibility of the trainer is quite important. It gives the student gunner an opportunity for some experience firing at high-speed targets which he could not gain otherwise except under conditions of actual warfare. The speed of travel of the target depends entirely upon how rapidly the hand crank is turned.

f. Sufficient 0.105-inch diameter galvanized steel wire is provided to install three trolleys, each about 100 feet in length. A bumper spring is furnished for each end of the trolley wires. Pulley

DESCRIPTION OF MAJOR COMPONENTS

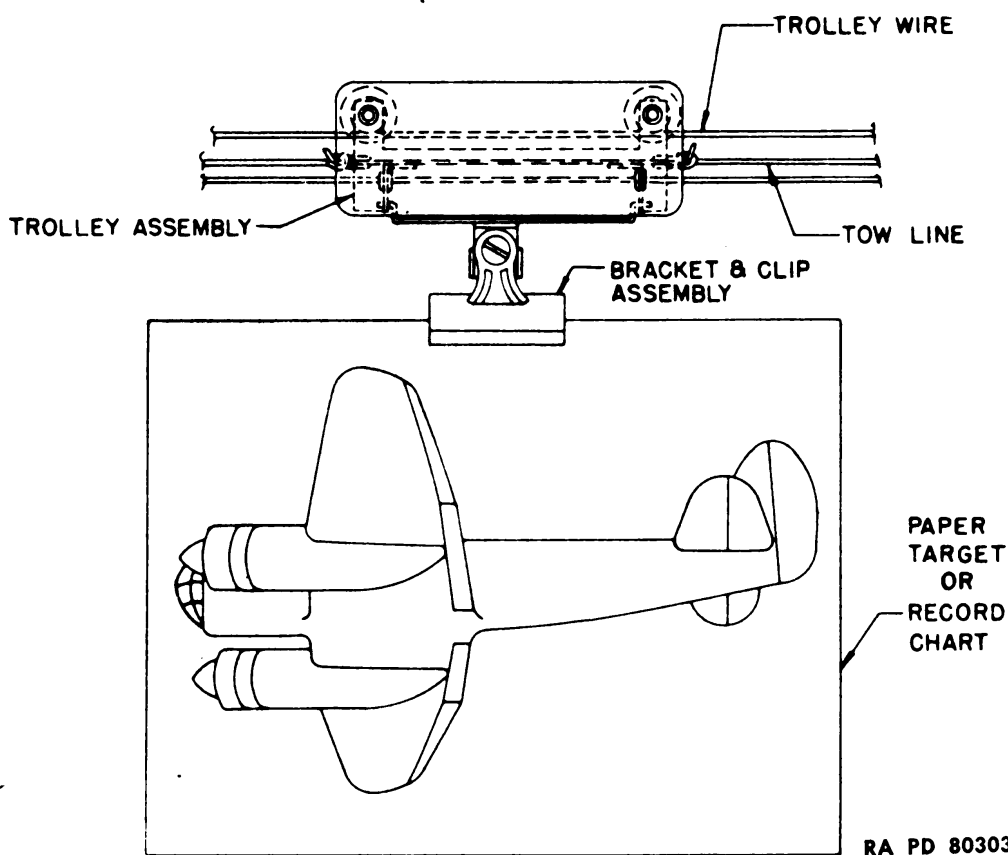


Figure 45 – Firing Record Chart Carriage with Chart

brackets for mounting on upright posts are supplied, to which the trolley wire may be attached. These brackets also carry the tow line, which is connected between the plane carriage and the reel (figs. 5 and 6).

g. No vertical supports are provided for the trolley wires. It is expected that the supporting pulley brackets can be mounted, either on the side walls of the building in which the Trainer M9 is installed, or on posts erected for this purpose as in the case of an outdoor set-up. As explained under paragraph 6 i, it is desirable to have the various courses set as high as is practicable, in order to cause the student to operate the gun through a rather wide vertical angle.

h. A special clip arrangement is provided to hook into the trolley plane carriage to support an 8½- by 11-inch card, as in figure 45. The card has a picture of a plane on it, which is cream in color against a dark background. This card is intended for use in making a permanent record of the hits or near hits obtained by a student, at any point in the course of instruction when such a record seems desirable. The pellets shoot holes through the paper target (record chart), leaving a permanent mark for scoring.

i. The reel and stand, previously described, is arranged with

ANTIAIRCRAFT MACHINE GUN TRAINER M9

the three reels set far enough apart, that each reel can be operated by a different man at the same time. They are not set in the same straight line, in order that they may be used to actuate the tow lines from three targets which of necessity can not be placed in the same line. Obviously, the trolley wires must be set a minimum of 15 inches apart, horizontally, in order that the planes can be moved simultaneously.

j. Back drops for the collection of pellets are not furnished with the equipment for the Trainer M9 (figs. 1 and 44). These can be readily made from standard target cloth, or similar material. Four to eight 6-foot widths sewed together will provide a satisfactory drop. The drop should be wide enough to extend either from wall to wall, or approximately 10 feet beyond either end of the maximum point of movement of the planes. Whenever it is possible, it is desirable for the back drop to be brought around the ends of the trolley wires and attached to a section turned up from the floor to catch the pellets. The floor cloth should be approximately 20 feet wide, from front to back. In the case of a wide target cloth, such as mentioned above, the floor cloth may be part of the width (fig. 1).

k. In the event that it is desirable to use a narrow width of back drop, sufficient cloth should be available to provide a back drop approximately 6 to 8 feet above the maximum point at which the plane will be fired upon, and approximately 8 to 10 feet below the lowest point of travel of the plane in the firing zone. The appearance of the path of the pellet, simulating the tracer stream, is more apparent when the back drop is located about 20 feet behind the target plane used. With the back drop sufficiently removed from the point at which the gun is aimed, it will be important to have a fair amount of cloth above and below the line of travel of the plane, in order to catch the pellets which have been misdirected. As the pellets approach the target, they tend to curve downward, which also makes it necessary to have a reasonable amount of cloth below the level of the trolley wire; otherwise, the pellets will be lost. The target cloth should be dyed dark green or black for best results.

14. ULTRAVIOLET LAMP.

a. An ultraviolet spot light of 250-watt capacity is provided with each gun for use in night firing. A filter lens in front of the bulb absorbs the visible light rays, but passes invisible ultraviolet rays, giving so-called black light. The filter lens also acts to filter out the harmful ultraviolet rays. For night operation with ultraviolet light, the gun is loaded with fluorescent pellets which are red in color, thus distinguishing them from the white daytime pellets. The unidentified plane is painted with phosphorescent and fluorescent paint. The phosphorescent paint will glow in the dark so that the plane can be distinguished without the aid of the ultraviolet light.

b. The ultraviolet lamp requires about 5 minutes to reach full

DESCRIPTION OF MAJOR COMPONENTS

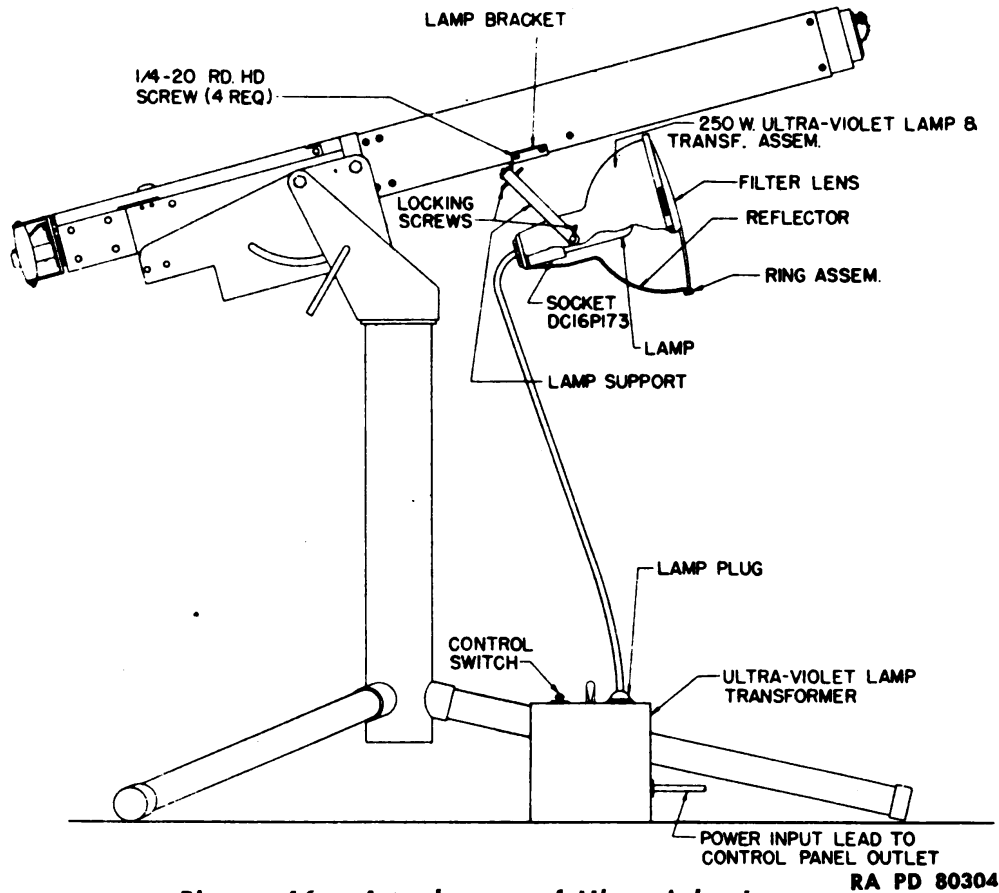


Figure 46 — Attachment of Ultraviolet Lamp

intensity. The human eye will gradually improve its accommodation to darkness for a period of about 20 minutes. It is therefore advisable to wait 5 or 10 minutes after turning on the ultraviolet lamp and turning off the room lights, before expecting maximum efficiency in night firing.

c. The ultraviolet lamp is arranged to be clamped to the gun water jacket so that the beam of light projected from it will follow a path similar to that followed by the pellets shot from the gun (fig. 46). One of the functions of the Trainer M9 is to develop a habit on the part of the gunner of watching the tracer stream at the target rather than at the gun muzzle. The ultraviolet light assists him in doing this at night, since the cone of light is focused at the plane; the light covers roughly a 5-foot circle, 50 feet from the gun. A convenience outlet is provided on the control unit for supplying power for the ultraviolet light. This outlet is controlled by the main switch.

NOTE: The ultraviolet light will start immediately after the electricity is turned on if the lamp is cold. If for any reason it is warm, when turned on, it will not light immediately. The lamp must have time to cool.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section VI

ADJUSTMENTS

	Paragraph
Sound unit	15
Gun	16
Air compressor	17
Targets	18
Ultraviolet light	19

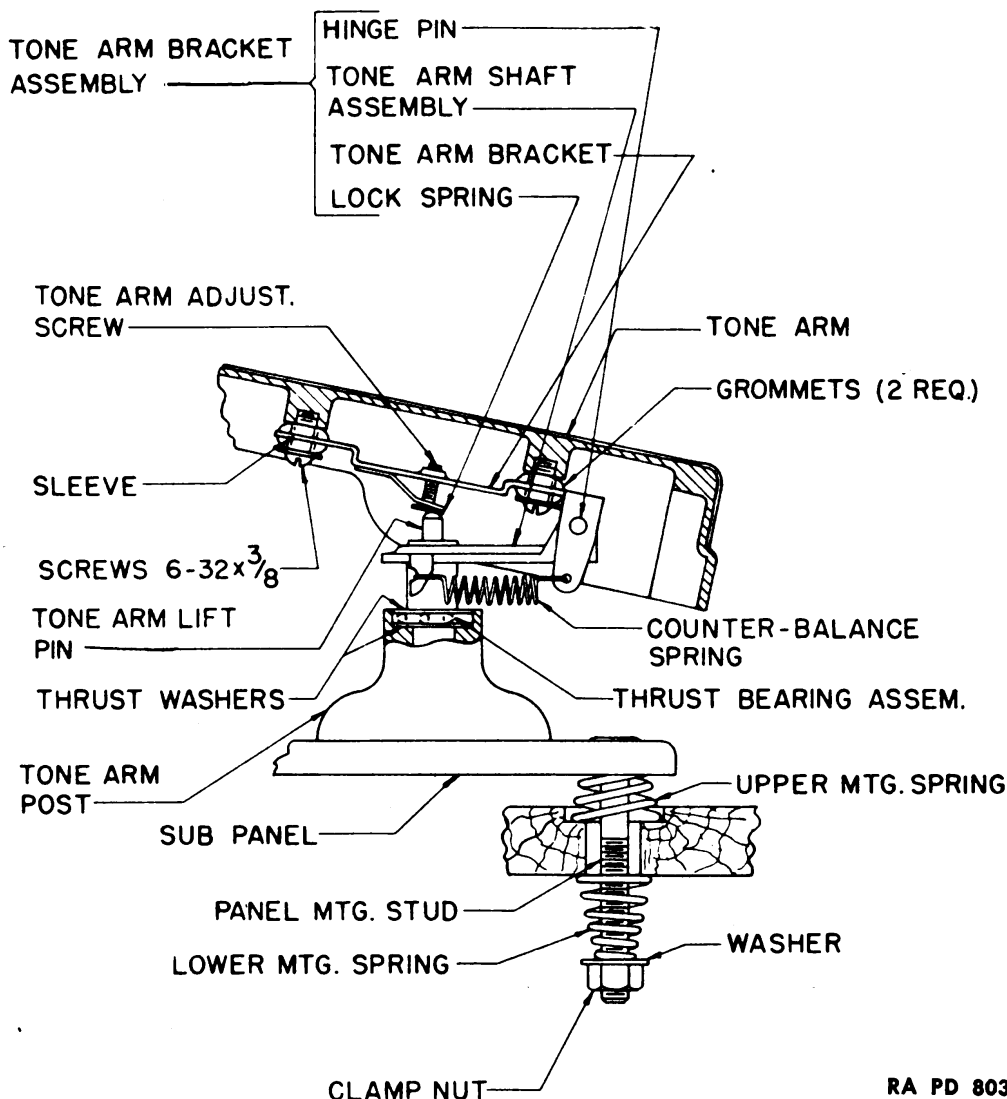
15. SOUND UNIT.

a. The volume control knob located at the right of the main switch on the control panel is for use in adjusting the volume of the battle sound (fig. 3).

b. Adjustments on the reproducing equipment involve the tone arm height, the tone arm hinge, minimum circle diameter trip, the booster spring setting, and the tone arm retard lever. The tone arm height adjustment screw (fig. 47) controls only the height of the tone arm when it is in the playing position with no record on the turntable. The correct setting of this adjustment screw is that which, under the above condition, allows the tone arm to descend until the needle point is very slightly below the level of the turntable surface. The tone arm adjustment screw should not be used to adjust the height to which the tone arm rises during a change cycle; this height is controlled solely by the length of the arm lift pin (fig. 47). Should the tone arm hinge show evidence of binding or impeding the free vertical movement of the tone arm, it may be necessary to replace this part (item 58 on fig. 48).

c. Adjustments of the automatic trip mechanism may be necessary. The changer incorporates a dual trip, to insure positive cutoff on various types of records. After the tone arm has played in far enough so that the distance of the needle from the center spindle is approximately $1\frac{7}{8}$ inches, the record changer will trip regardless of whether or not there is a cutoff or eccentric groove on the record. This type of trip is known as a "minimum diameter trip." The diameter of the minimum circle is set at the factory to be approximately $3\frac{3}{4}$ inches. Variations in adjustment, or readjustment of this operation, can be obtained by moving the position of the trip shoe slightly (item 29 on fig. 49). The trip shoe is locked in position by means of a screw when the adjustment has been satisfactorily completed. This screw must be adjusted through a hole cut in the main drive gear when the machine is not in a change cycle.

ADJUSTMENTS



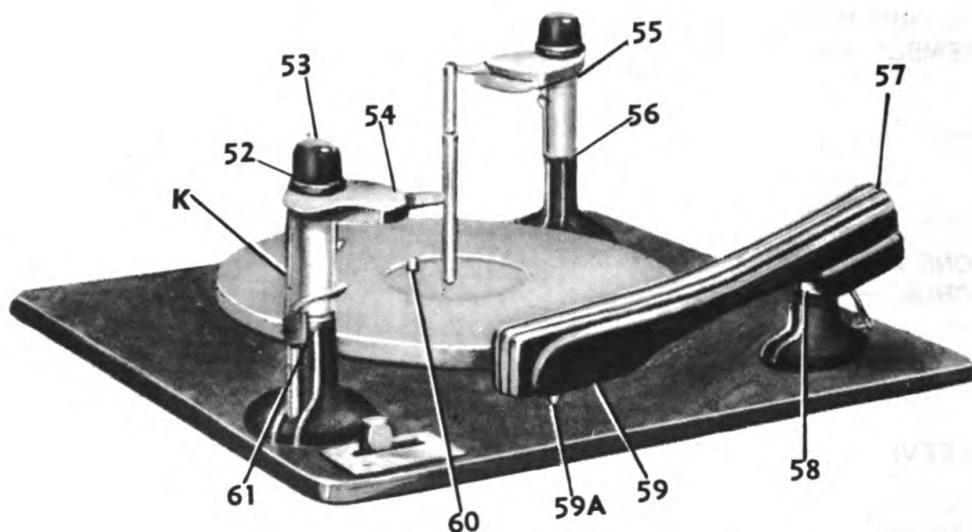
RA PD 80305

Figure 47 – Tone Arm Mounting Assembly

d. In order to make the trip action of the changer mechanism operate under various conditions, a second tripping device has been included, which operates due to any outward movement of the tone arm after it has played to within approximately $2\frac{1}{2}$ inches of the center spindle. This trip is actuated by a small dog and ratchet combination, but requires no adjustment (fig. 49).

e. The function of the booster spring (item 30 on fig. 49) is to move the needle from the margin of the record into the first groove automatically. Most present day records have what is known as a "lead-in groove" which automatically carries the needle from the margin of the record into the record grooves. In the case of older type records, and particularly those of the mechanically recorded type which have no lead-in groove, the booster spring supplies just enough

ANTIAIRCRAFT MACHINE GUN TRAINER M9



ITEM NO.	DESCRIPTION
52	TURNTABLE
53	CONTROL KNOB
54	{SELECTOR ARM & BLADE }ASSEMBLY NO. 1
55	{SELECTOR ARM & BLADE }ASSEMBLY NO. 2
56	THRUST WASHER
57	TONE ARM
58	TONE ARM MOUNTING ASSEMBLY*
59	TONE ARM CARTRIDGE
59A	ALLOY NEEDLE
60	RETRACTABLE PIN
61	12" SET ROD

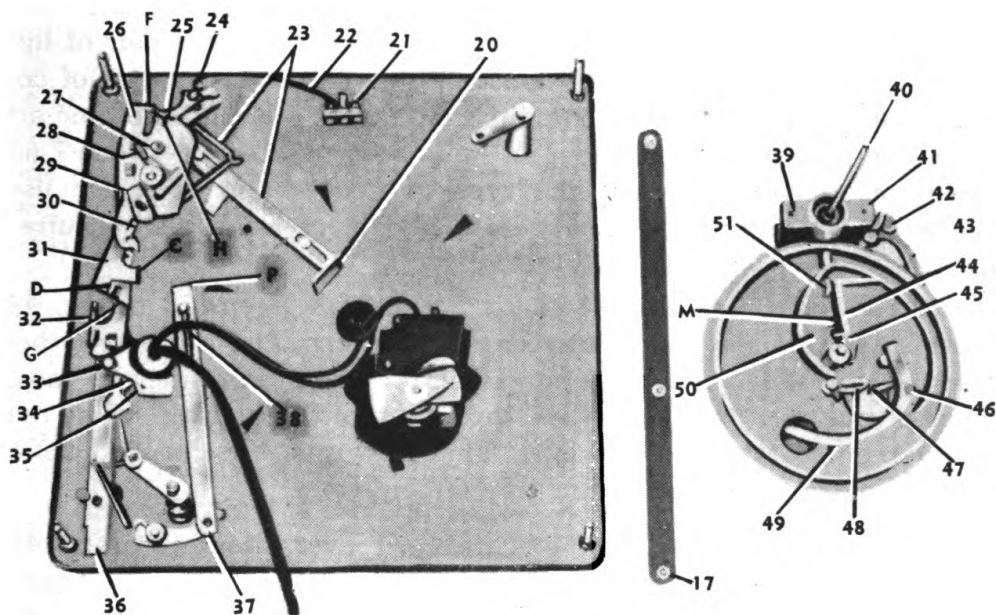
(*) SEE FIG. 47 FOR DETAIL ASSEM.

RA PD 80306

Figure 48 — Record Changer — Top View

pressure to move the needle across the margin to the record grooves. This booster spring is built into the tone arm locator lever (item 31 on fig. 49), and consists of a single piece of light spring wire (item 30 on fig. 49). The side pressure exerted by this spring should be just sufficient so that the needle will move across the margin of a record which contains no lead-in groove. After any adjustment of the booster spring, check its operation on both 10-inch and 12-inch records to make sure that it functions properly. Do not increase the operating pressure

ADJUSTMENTS



ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
20	MANUAL & REJECT LEVER	38	12" RESET LEVER SPRING
21	TERMINAL STRIP	39	SPINDLE & PINION GEAR ASSEMBLY *
22	SHIELDED WIRE	40	TURNTABLE SPINDLE ASSEMBLY *
23	TONE ARM LOCATOR (& LATCH) SPRING	41	CLUTCH ENGAGEMENT LEVER
24	TONE ARM LATCH LEVER	42	STOP LEVER PIVOT PIN *
25	TONE ARM LEVER ASSEMBLY	43	DRIVE GEAR STOP LEVER ASSEMBLY *
26	CONNECTING LINK	44	TRIP LEVER ASSEMBLY
27	TONE ARM LIFT PIN	45	TRIP LEVER SHOULDER SCREW
28	CAP SCREW 1/4"-20	46	RETARD LEVER SHOULDER SCREW
29	TRIP SHOE	47	RETARD LEVER SPRING
30	BOOSTER SPRING	48	TRIP DOG SPRING
31	TONE ARM LOCATOR ASSEMBLY	49	TONE ARM RETARD LEVER
32	UPPER SLIDE SPRING	50	TRIP LEVER SPRING
33	LOWER SLIDE SPRING	51	CLUTCH ENGAGEMENT LEVER, PIN
34	A.C. SWITCH		
35	SWITCH PLATE ASSEMBLY		
36	CONTROL LEVER ASSEMBLY		
37	12" RESET LEVER		

(*) SEE FIG. 54 FOR DETAIL ASSEMBLY

RA PD 80307

Figure 49 — Record Changer — Disassembled — Underside View

ANTIAIRCRAFT MACHINE GUN TRAINER M9

of the booster spring to such a point that it tends to make the needle slide across the first few record grooves. Access to the booster spring can be obtained when the tone arm is in the "REST" position, with the switch knob turned "OFF," by moving the tone arm locator lever assembly out toward the edge of the changer subpanel with the finger. Adjustment of the spring tension should be made with a pair of light pliers or with the fingers. The tension, measured at the point of contact between the booster spring (item 30 on fig. 49) and the tone arm lever (item 25 on fig. 49), is set at the factory to values between 7 and 15 grams depending upon the type of needle and cartridge used (cartridges requiring extremely light needle pressure also require a light booster spring tension).

CAUTION: The shielded pick-up lead wire (item 22 on fig. 49) must have sufficient slack between the tone arm and the point where the tone arm lead enters the subpanel, to permit free sidewise movement of the tone arm; otherwise, the action of the booster spring may be overcome or overemphasized. This lead must be checked before attempting any booster spring adjustments.

f. The function of the tone arm retard lever (item 49 on fig. 49) is to provide a smooth motion of the tone arm as it moves from the outer edge of the panel in towards the edge of the record to be played during an automatic change cycle. An additional function is to prevent action of the booster spring (item 30 on fig. 49) until the needle has lowered on to the outer edge of the record to be played. *Insufficient* tension of the tone arm retard lever spring (item 47 on fig. 49) will permit action of the booster spring before the needle comes to rest on the record, giving the effect of incorrect tone arm indexing. *Excessive* pressure of the tone arm retard lever spring will cause rough, jerky action of the tone arm as it moves from the outer edge of the changer panel.

16. GUN.

a. Under normal circumstances, no adjustments are necessary on the gun.

17. AIR COMPRESSOR.

a. If the belt is loose, the slack should be taken up by sliding the motor. When the belt tension is adjusted, be sure to realine the pulleys.

b. The cut-off pressure of the automatic switch can be regulated by adjusting the screw located in the center of the switch housing, which is under the cover plate (fig. 38). To reduce the pressure, the screw should be turned clockwise. A slight adjustment will make a considerable change in the pressure cut-off point.

ADJUSTMENTS

18. TARGETS.

a. Targets installed in accordance with section III should require no further adjustment in order to provide satisfactory operation.

19. ULTRAVIOLET LIGHT.

a. After assembly and attachment of the ultraviolet lamp, only the bracket should require adjustment. It should be so adjusted that a pellet fired from the gun will strike a stationary target plane in the cone of light projected by the lamp. In order to do this, the locking lever of the gun cradle should be tightened when the gun is in such a position that pellets fired from it will strike one of the target planes held stationary in the field of fire. With the gun locked in that position, the ultraviolet light should be focused so that the plane is in approximately the center of the beam. This will provide the proper vertical and horizontal adjustment of the lamp.

NOTE: The ultraviolet light will start immediately after the electricity is turned on if the lamp is cold. If, for any reason, it is warm when turned on, it will not light immediately. It must have time to cool.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section VII

CARE AND PRESERVATION

	Paragraph
Lubrication	20
Cleaning	21
Handling and storage	22
Cautions	23

20. LUBRICATION.

a. Sound Equipment.

(1) With the exceptions of the record changer and turntable equipment, no lubrication is required on the sound equipment. The motor is equipped with oilless bearings, and therefore requires no lubrication.

(2) The turntable spindle bearings are lubricated at the factory and do not require any lubrication for one year. After one year, they should be oiled every 6 months with one or two drops of OIL, engine, SAE 10. Do not overoil. The top bearing can be oiled by lifting off the turntable. Make sure, when replacing the turntable, that the pin in the turntable spindle slips into the slot on the bottom surface of the turntable hub. Also, care should be taken not to damage the motor idler pulley. Never, under any circumstances, allow oil to come in contact with the motor idler pulley.

(3) The motor bearings on the timing and sound equipment (fig. 21) should be oiled at least every 6 months with 6 or 8 drops of OIL, engine, SAE 30, above +32F, and OIL, engine, SAE 10, for temperatures between +32 F and 0 F.

(4) Maintain oil level in the timer gear box as shown on figure 23, using OIL, engine, SAE 10, for all temperatures above 0 F.

b. Gun. It is necessary to lubricate oil points in the gun daily with OIL, lubricating, preservative, light. Of course, where an excess of oil is indicated, it should be removed and the addition of oil omitted until such time as it is required (Gun Lubrication Guide, figure 50). A drop of oil should be placed on each surface of the slides on the electromagnets and recoil mechanism, daily; avoid excess oil, as oil will tend to ruin the insulation on the coils. Any excess oil should be removed with a cloth.

c. Air Compressor.

(1) The air compressor is delivered without oil in the crankcase. The crankcase should be filled to the "FULL" level marked on the

CARE AND PRESERVATION

KEY

Lubricants	Intervals
OG — GREASE, O.D. No. 0 (above +32° F.) No. 00 (below +32° F.)	D — Daily
PL — OIL, lubricating, preservative, light	W — Weekly

Daily, fill oil cups and apply 1 or 2 drops of oil to moving surfaces on electromagnets. Avoid oil on electromagnet coils.

Interval

D

Daily apply 1 or 2 drops of oil for free movement.

Daily apply 1 or 2 drops of oil to moving surfaces on handle support guides

Lubricant
PL Recoil Plunger
(Oil cup)

PL Electromagnets
(Note 1)

D PL Cradle Swivel Pin Pivots
(Note 3)

D PL Piston
(Oil cup)

D PL Handle Support Guides
(Note 2)

W OG Swivel — Mount
Tubular Projection
(Note 4)

Note: Wherever oil is called for, use oil, lubricating, preservative, light

Weekly coat surfaces sparingly with GREASE, O.D., No. 0, for temperatures above +32° F. For temperatures below +32° F., use GREASE, O.D., No. 00.

NOTES

1. Daily apply 1 or 2 drops of PL to each moving surface of the slides on the electromagnets and recoil mechanism. Avoid any excess oil on electromagnet coils.
2. Daily apply 6 or 8 drops of PL to moving surfaces.
3. Daily apply 1 or 2 drops to pivot points to allow free movement of gun in cradle.
4. Weekly coat surfaces sparingly with OG.

RA PD 80308

Figure 50 — Gun Lubrication Guide

ANTIAIRCRAFT MACHINE GUN TRAINER M9

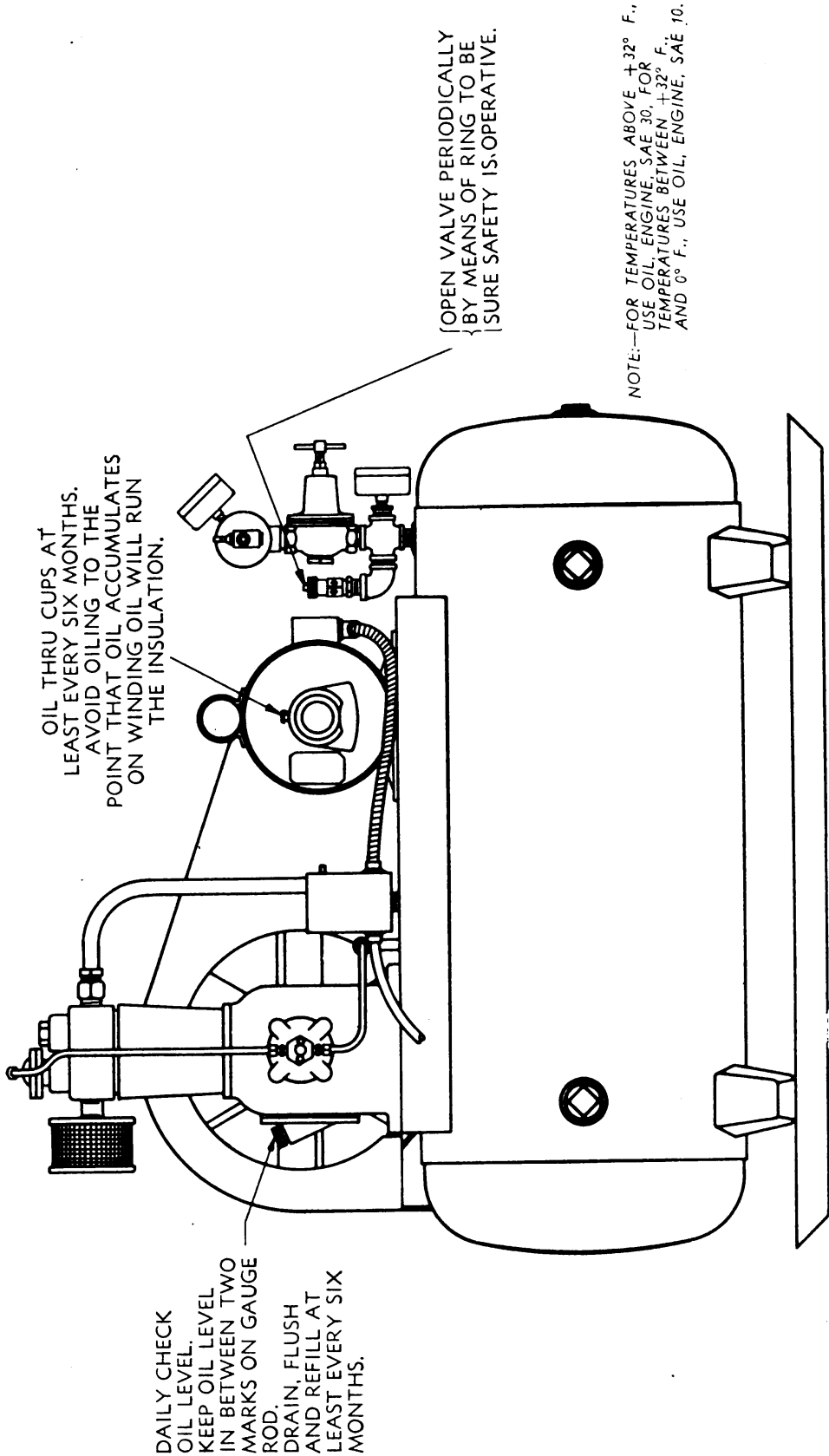


Figure 51 — Compressor Lubrication Guide

RA PD 80309

CARE AND PRESERVATION

RA PD 80310

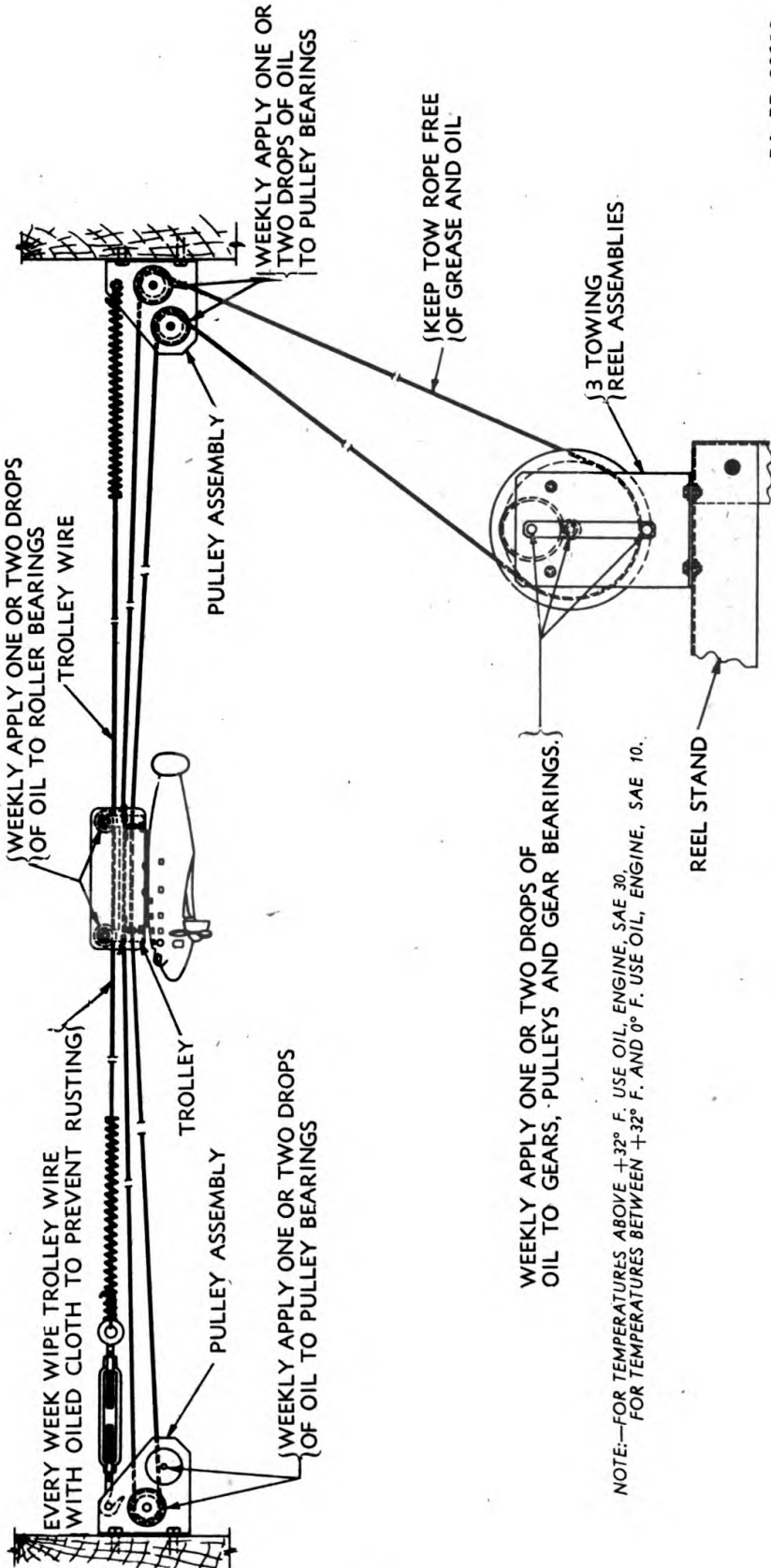


Figure 52 — Target Lubrication Guide

ANTIAIRCRAFT MACHINE GUN TRAINER M9

oil gage, and additional oil should be added whenever the oil falls below the "LOW" mark (fig. 51). Use OIL, engine, SAE 30, for temperatures above +32 F. If the compressor is to be operated at temperatures between +32 and 0 F, use OIL, engine, SAE 10.

(2) The reservoirs on both ends of the motor should be oiled before starting and should be reoiled by adding oil every 6 months. Use OIL, engine, SAE 30, for all temperatures above +32 F, and OIL, engine, SAE 10 for temperatures between +32 F and 0 F.

d. **Targets.** It is important to keep the bearings of the various pulleys and reels on the targets lubricated (fig. 52). A few drops of OIL, engine, SAE 30, will be adequate. Remove any excess oil which may have accumulated on the brackets and supports, to avoid saturating the tow lines and the airplanes with oil.

e. **Ultraviolet Light Equipment.** No lubrication is required for this part of the equipment.

21. CLEANING.

a. Sound Equipment.

(1) A periodic cleaning will preserve the life of the equipment. The interval will depend to some extent upon the location of the units. Dust should be removed from the battle sound record by means of a soft cloth. In doing this, move the cloth in a light circular motion. Even a fine film of dust may cause very rapid wear of the record.

(2) Excessive dust and grit must be removed from the interior of the sound cabinet, including the timer and explosion sound unit. If oil tends to accumulate on the timer equipment, it should be removed periodically by wiping it with a cloth, saturated with SOLVENT, dry-cleaning. Among other things, this will prevent the occurrence of small fires.

b. Gun.

(1) The interval between gun cleanings, will be governed, to some extent, by the location in which the gun is operated. The mechanism should be freed of accumulated oil, grease, and dust, sufficiently often to prevent unsightly appearance, soiling of clothes, and sluggish operation. The elements to be removed will probably be concentrated about the tripod, the gun mount, electromagnets, and the recoil mechanism. Aside from the general bad appearance caused by these accumulations, an effort must be made to prevent the coils of the electromagnets becoming oil-soaked. Oil is detrimental to the insulation and should be removed with CARBON TETRACHLORIDE.

(2) In the event that dirt is permitted to enter the magazine of the firing chamber, it can be removed by either tilting the gun muzzle downward or by blowing out the barrel with high-pressure air. Small particles of dirt in the magazine will fall out if the plug at the muzzle

CARE AND PRESERVATION

is removed and the barrel tipped downward. If this method is not successful, blow out the magazine with 60 to 70 pounds of air pressure by holding an air hose against the magazine intake after the plug has been removed. This will carry any loose particles through the magazine into the firing chamber and out the barrel (figs. 31 and 35).

CAUTION: Before attempting such an operation, make certain there are no pellets in either the magazine, firing chamber, or gun barrel. In blowing out the magazine, the operator must stand aside so that the air exhausted from the gun muzzle does not strike him. This is important, as small particles being blown with high-pressure air, may do considerable damage.

c. Air Compressor.

(1) Like the other electrical equipment, the compressor and electric motor should be kept free of excess oil and grease, especially on the insulated parts, to prolong the life of the insulation.

(2) The lubricating oil in the crankcase of the compressor should be changed at least every 6 months. Before replacing old oil with new, flush out the crankcase with OIL, engine, SAE 10.

(3) Any accumulation of oil and dirt, on the external portions of the air compressor, must be removed as it accumulates. The accumulation will not only lead to bad appearance, but will tend to cause difficulty with specific parts such as the belt. The accumulation of grease on the belt will tend to destroy the material from which it is made and also cause it to slip. Clean electric motor and belt with carbon tetrachloride.

d. Targets. Except for the occasional removal of the accumulation of dirt and excess oil, the targets will require little attention in the way of cleaning. The trolley wires should be wiped regularly with an oiled cloth to keep them from corroding; the intervals of such wiping will depend largely on the atmosphere in which they are being operated. In dry climates, the interval can be considerably longer than installations where moisture is prevalent.

e. Ultraviolet Light. The ultraviolet equipment presents no problem in cleaning, with the exception of the occasional removal of the accumulation of dust.

22. HANDLING AND STORAGE.

a. If it should be necessary to move the equipment after it has been set up for use, it should be broken down into units similar to the manner in which it was broken down when received. Of course, if the distance it is to be moved is slight, that is, within the same building, this may not be necessary, with the exception of the target trolley system. If the distance is great, it should of course be crated. In preparing for a distant move or for crating, the sound equipment

ANTIAIRCRAFT MACHINE GUN TRAINER M9

should be separated into the control unit, the speaker unit, and the supporting members, as outlined in paragraph 6. The supports under the control unit must be released at the back ends, and rotated until they are parallel with the side walls of the cabinet. In this position, the speaker may be set on end so that the front or small end is resting on the control unit supports. The bolts taken from the back of the control unit base are to be used to bolt the speaker unit through holes which were provided for the original pack. The uprights that were mounted on the back of the control cabinet should be used to tie the top of the control cabinet and speaker unit together, utilizing the bolts that were used for the assembly of the units. A dowel pin in either side of the top end of the speaker is provided to cooperate with suitable holes in the uprights and will act as a guide for locating and fastening the uprights across the top, by means of the holes utilized in the original shipment of the parts.

b. Likewise, the gun and target units must be dismantled. In the case of the gun, it is simply necessary to disconnect the air hose from the compressor, and the power supply cord from the control unit and lift the gun swivel out of the tripod. The legs of the tripod can then be readily unscrewed from the pedestal. If an ultraviolet lamp is attached to the gun being moved, it will be necessary to separate the lamp from the gun by loosening the thumbscrew which holds the lamp to the bracket on the under side of the gun barrel.

c. It may be desirable to crate the reel assembly without dismantling. This will be satisfactory.

d. Keep grease off electrical coils, etc. When storing, it is particularly important that the moving parts in the equipment be protected against rust. The various elements should be covered with a tarpaulin, or wrapped and crated to prevent dust and grit from accumulating on the mechanism.

23. CAUTIONS.

a. Be sure that the power source to which the Antiaircraft Machine Gun Trainer M9 is connected, is for 110-volt, 60-cycle operation, unless the equipment has been provided with mechanism especially designed for some other frequency or voltage.

b. The lead wire, which emerges from the rear of the tone arm of the record changer and goes down through the metal base plate, must be so placed in the panel that it will not restrict the free movement of the tone arm across the record. It is important that the wire be free and loose at all times. Do not attempt to push the excess wire through the panel.

c. Do not increase the cut-off point on the automatic switch on the air compressor above 75 pounds.

CARE AND PRESERVATION

d. Daily check the oil in the air compressor crankcase to be sure sufficient oil is present.

e. Changing the air pressure to the guns, will change the time of flight of the pellets. Twenty pounds pressure produces a time of flight of approximately 0.58 second, through a travel of 50 feet. This is comparable to the 0.62 second required for a cal. .50 bullet to travel from the gun muzzle to a target at 500 yards range, based on a 1:30 scale operation.

f. Always turn the firing switch to "OFF" before loading. This will prevent possible injury to the man loading the magazine.

g. The muzzle blast sound effect is intended for use with the recoil effect. If the recoil is cut off and the gun sound operated, there may be distortion of the sound due to an internal electrical disturbance set up. This disturbance is normal, and will disappear when the recoil effect is produced with the gun sound.

h. If the main switch has been turned to "OFF," the sound effect will not appear at once, if the gun is fired immediately after turning the main switch to "ON." This is because about 4 seconds are required for the speaker field coils to build up sufficient energy to operate normally; also the battle sound amplifier tubes must become warm.

i. Always have switch control knob of record changer in manual position when the tone arm is moved manually. Failure to do this will injure the tone arm mechanism.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section VIII

TROUBLE SHOOTING

	Paragraph
Trouble shooting and remedial measures.....	24
Sound equipment	25
Gun	26
Air compressor	27
Target	28
Ultraviolet lamp	29

24. TROUBLE SHOOTING AND REMEDIAL MEASURES.

a. The following chart lists common troubles, their causes, and a recommended correction procedure for each.

b. Sound Equipment.

Possible Cause	Possible Remedy
Battle sound not reproduced.	
Amplifier tubes improperly located.	Position tubes correctly (par 25 a).
Faulty reproduction of battle sound.	
Worn record.	Replace record (par. 25 b).
Poor tone.	
Worn needle.	Replace needle.
Sound equipment howls.	
Changer contacts cabinet at any point other than at the four corners where it rests on mounting springs; mounting plate studs rub against sides of holes in cabinet panel.	Loosen the mounting springs (par. 25 c).
Rumble occurs.	
Jarring of turntable.	Inspect pulley and rotate spindle (par. 25 d).
"Wow" or "speed variation" occurs.	
Turntable spindle tends to bind.	Lubricate two spindle bearings (par. 25 e).
Turntable shaft is bent.	Replace entire spindle and pinion gear assembly (par. 25 e).

TROUBLE SHOOTING

Possible Cause	Possible Remedy
Repeated trippings occur.	
Clutch engagement lever does not lock positively into up position.	Remove dirt from bearing point of trip lever. Strengthen trip lever spring (par. 25 f).
Switch knob does not return to "AUTOMATIC" position when released.	See paragraph 25 g.
Record changer fails to trip.	
Clutch engagement lever sticks in the "UP" position.	See paragraph 25 b.
Insufficient power to complete a change cycle.	See paragraph 25 i.
Mechanism jams during a change cycle.	
Binding of turntable.	Free the machine (par. 25 j).
Damaged or missing parts on under side of changer panel.	See paragraph 25 j.
Drive gears do not mesh; clutch engagement lever bent.	Straighten lever (par. 25 j).
Failure of simulated gun sound to be audible.	
Broken voice coil in the speaker.	Replace cone housing, cone and voice coil (par. 25 k).
Extreme distortion or poor reproduction.	
Broken speaker cone.	Replace cone housing, cone and voice coil (par. 25 k).
Distorted or double tone effect in simulated muzzle blast.	
Operation of gun sound without recoil effect.	Turn recoil switch to "ON" (par. 25 l).
Poor volume of gun sound.	
Poor adjustment of gun sound cam on timer.	Adjust gun sound cam on timer (par. 25 m).

ANTIAIRCRAFT MACHINE GUN TRAINER M9

c. Gun.

Possible Cause	Possible Remedy
Pellets jam while loading magazine.	
Broken pellet or dirt mixed with pellets.	Remove pellet (par. 26 a).
Pellets jam in barrel.	
Broken pellets or dirt mixed with pellets.	Blow out pellets (par. 26 h). Remove pellets (par. 26 h).
Failure of pellets to discharge from gun when trigger is depressed.	
Lack of air.	Check compressor (par. 26 c).
Low voltage.	Check voltage (par. 26 d).
Pellet stuck in barrel.	Remove pellet (par. 26 b).
Wild shots.	See paragraphs 26 e and f.
Inadequate recoil.	
Insufficient lubrication of electro-magnet frame.	Lubricate (par. 26 g).
Poor adjustment of breaker assembly and timer.	Adjust breaker assembly and timer (par. 26 g).
Excessive arcing of timer contacts.	
Breaking of circuit at other than zero point of alternating-current curve.	Adjust breaker assembly and timer (par. 26 h).
Gun misses fire.	
Poor contact surfaces on trigger switch.	Clean contacts (par. 26 i).
Gun fires moist pellets.	See paragraph 27 c.

d. Air Compressor.

Motor does not come up to full speed; cuts on and off continuously when it approaches cut-off point.	
Low voltage.	Check voltage and correct (par. 27 a).
Motor runs through unusually long intervals.	
Loose belt.	Adjust belt tension (par. 27 a).

TROUBLE SHOOTING

Possible Cause	Possible Remedy
Compressor tends to overheat.	
Flywheel operates in wrong direction.	Adjust flywheel (par. 27 b).
Gun discharges moist pellets.	
Moisture compressor pressure tank.	Drain compressor pressure tank (par. 27 c).
e. Target.	
Target fails to function.	
Mechanical difficulties.	Adjust (par. 28 a).
f. Ultraviolet Lamp.	
Failure of lamp to start.	
Warm lamp.	No defect (see par. 29 a).
Pellets not visible in dark.	
Wrong (white) pellets used.	Change to red pellets (par. 29 b).
Poor focus of lamp.	Focus the lamp (par. 29 c).

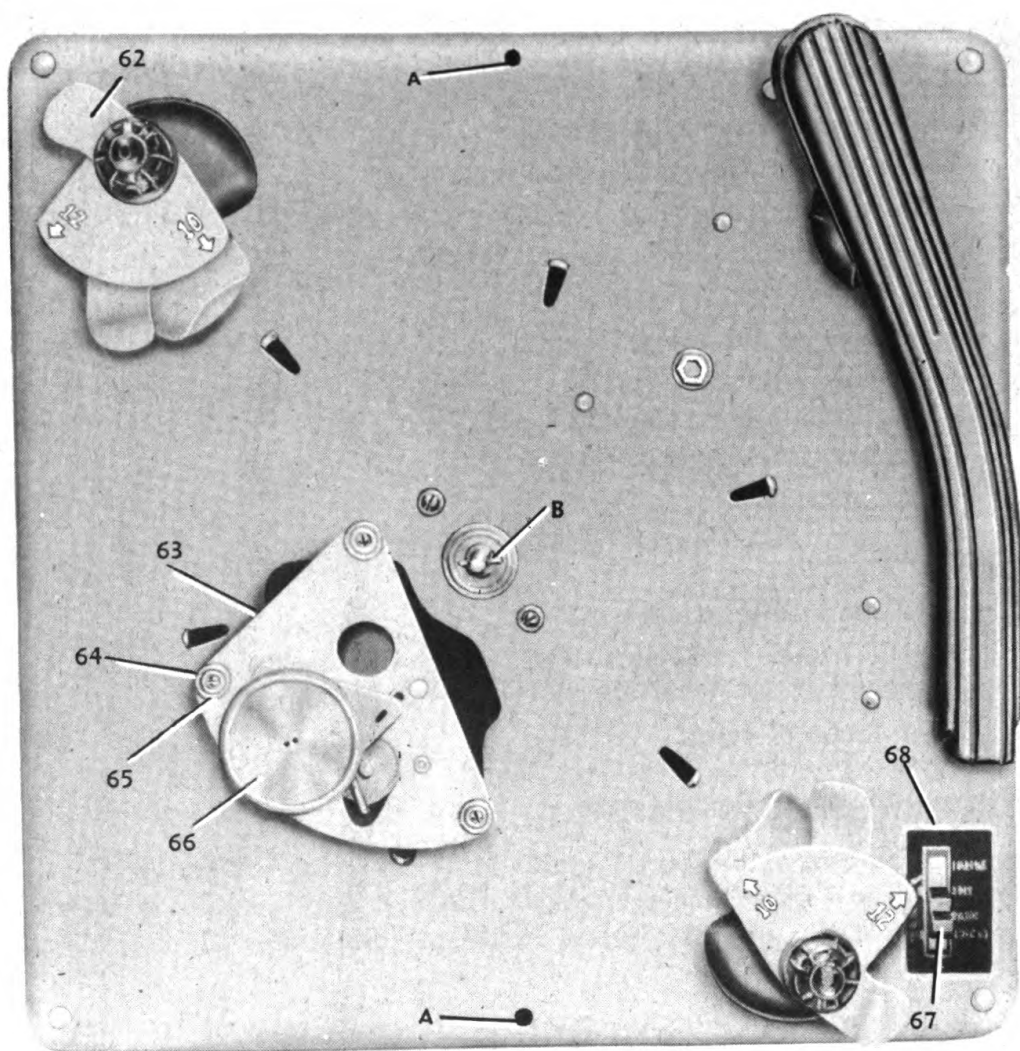
25. SOUND EQUIPMENT.

a. Failure of the battle sound to be reproduced when proper connections are made and switches turned on may be due to improper location of the amplifier tubes. Figure 26 designates the correct position of each tube.

b. Faulty reproduction in the battle sound reproducing unit may indicate the record is badly worn. A poor tone may be evidence of a worn needle.

c. If sound equipment howls, inspect the under side of the panel to make sure that the changer does not come into contact with any part of the cabinet at any point other than at the four corners where it rests on the mounting springs. Also check to be sure that the studs (item 14 on fig. 55) do not rub against the side of the holes in the cabinet panel. A tendency toward microphonism may be due to any one, or all, of the four mounting springs being drawn down too tightly; loosening these mounting springs will reduce any tendency toward feedback. It should be remembered that there is no disadvantage in any phonograph equipment which tends to become microphonic at volume control settings above those in the usable range. That is, if the set does not feedback up to the volume control settings at which distortion appears when playing an average record, it will operate satisfactorily.

ANTIAIRCRAFT MACHINE GUN TRAINER M9



ITEM NO.	DESCRIPTION
62	12" SELECTOR BLADE
63	MOTOR ASSEMBLY
64	MOTOR MOUNTING BUSHINGS
65	MOTOR GROMMET
66	MOTOR IDLER PULLEY
67	SWITCH CONTROL KNOB
68	CONTROL ESCUTCHEON

RA PD 80311

Figure 53 — Record Changer — Disassembled — Top View

TROUBLE SHOOTING

d. If rumble occurs, remove the turntable and inspect the rubber-rimmed motor idler pulley (item 66 on fig. 53) for flat or worn spots which would tend to jar the turntable. With the turntable removed, rotate the turntable spindle to be sure that it turns smoothly.

e. If "wow" or "speed variation" occurs, remove the turntable and rotate the turntable spindle (item 40 on fig. 49) with the fingers to determine whether it tends to bind. High friction at this point may be sufficient to cause the motor to slow down instantaneously. Apply only one drop or two of OIL, engine, SAE 10, to the two spindle bearings. If the turntable shaft is bent to such an extent that replacement is necessary, it is recommended that the entire spindle and pinion gear assembly (item 39 on fig. 49 and fig. 54) be replaced, instead of replacing only the spindle. This spindle and pinion gear assembly (fig. 54) is fitted by precision machines at the factory, thus insuring clearances and smooth operation.

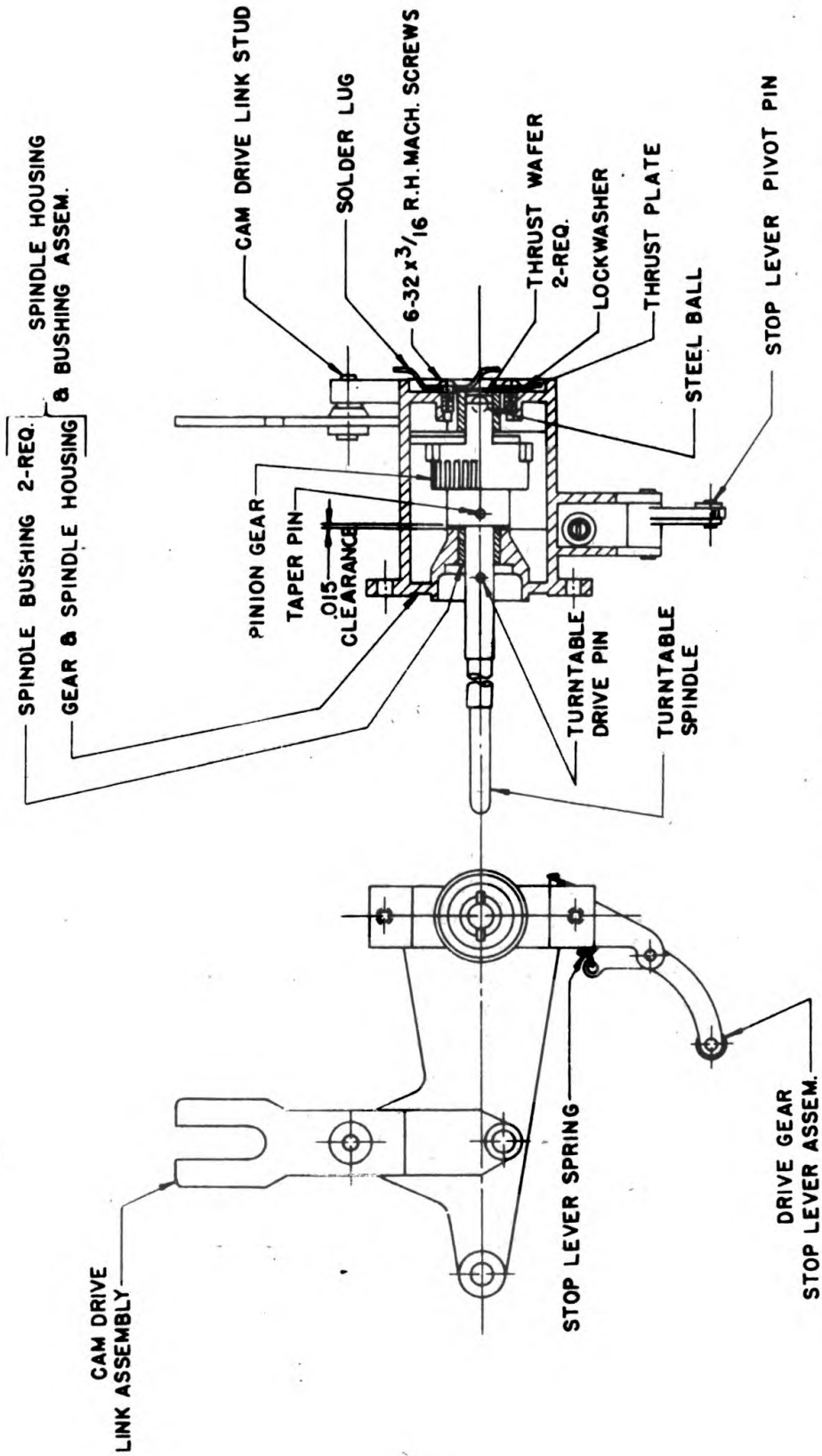
f. If repeated tripping occurs, turn off the changer during a change cycle, so that the clutch engagement lever (item 41 on fig. 49) may be moved up and down with the finger. This clutch engagement lever should lock into the "UP" position due to its engagement with the trip lever (item 44 on fig. 49) at the point "M." If this engagement is not positive, inspect the bearing point of the trip lever (item 44 on fig. 49) for evidence of dirt or binding. A more positive engagement may be obtained by strengthening the spring (item 50 on fig. 49). This spring tension must be *just sufficient* to lock the clutch engagement lever in the "UP" position. Excessive tension on the spring will result in failure to trip.

g. Repeated tripping may also be due to the fact that the switch knob does not return to the "AUTOMATIC" position when released. This condition can result from binding of the roller lever (item 6 on fig. 55) on its bearing; insufficient tension in the spring (item 9 on fig. 55); or excessive friction or binding in the motion of the control lever (item 36 on fig. 49).

h. If the record changer fails to trip, turn off the changer during a change cycle so that the clutch engagement lever (item 41 on fig. 49) may be actuated with the finger while the trip lever is being held away, so that the engagement lever does not lock in the "UP" position. The clutch engagement lever must not stick in the "UP" position due to binding at any point.

CAUTION: It is not advisable to use any lubricant at the bearing point of the clutch engagement lever (item 51 on fig. 49); this bearing is intended to be a loose fit, run dry, and operate due to gravity. Excessive pressure on the spring (item 50 on fig. 49) would tend to make the needle jump out of the cut-off groove of the record (subpar. f above) and prevent tripping. The shielded pick-up lead wire

ANTIAIRCRAFT MACHINE GUN TRAINER M9



RA PD 80312

Figure 54 — Spindle and Housing Assembly

TROUBLE SHOOTING

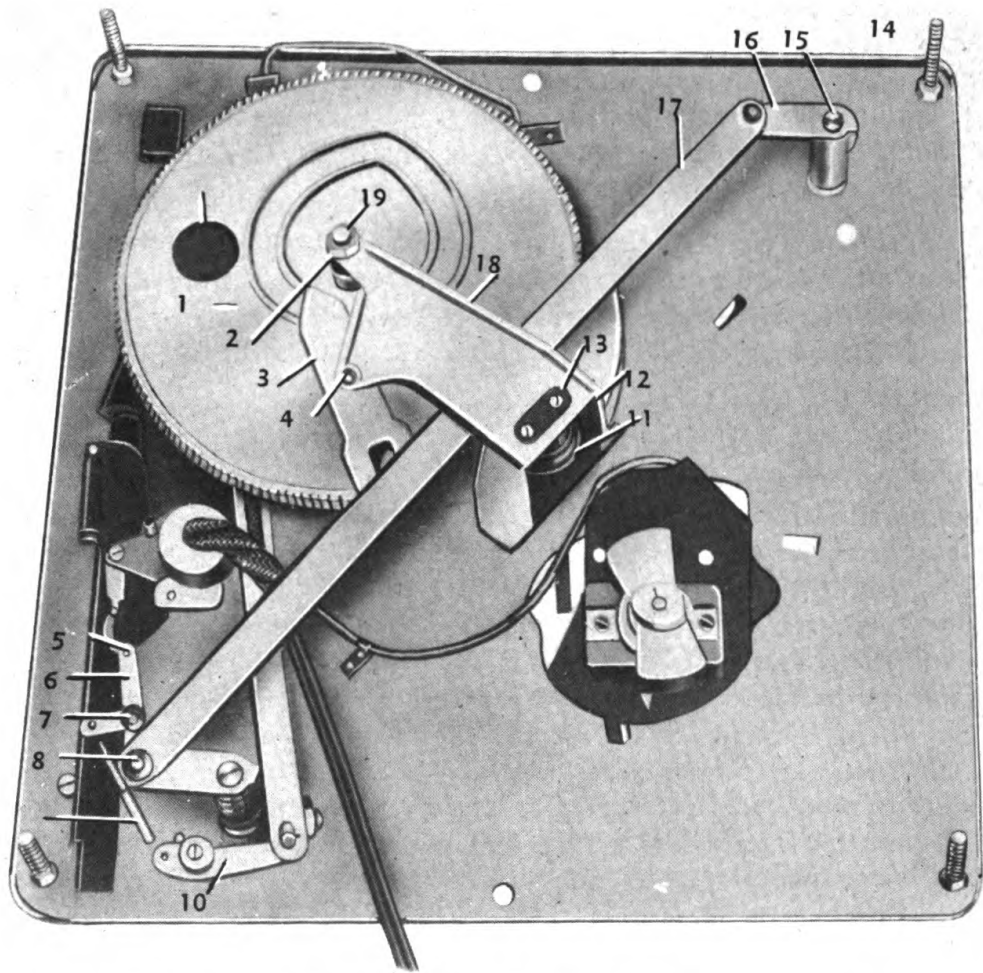
(item 22 on fig. 49) must have sufficient slack between the tone arm and the point where the tone arm lead enters the subpanel to permit free sidewise movement of the tone arm. The shielded lead should be so positioned that it loosely rests near the tone arm post, immediately below the point at which it leaves the tone arm bracket. Under no circumstances should the shielded wire be fastened in place, pulled taut, nor should it restrict free tone arm movement.

i. If there is insufficient power to complete a change cycle, inspect the bearing of the main drive gear (item 1 on fig. 55) for excessive friction or binding. Inspect the selector arm bearings for excessive friction or binding.

j. If the mechanism should jam at any time during a change cycle for some reason other than jamming of the selector arms with the records being changed, remove the records, and attempt to free the machine by rotating the turntable in a reverse direction through one-quarter turn. If the jam is apparently cleared by such action, the machine should be checked by operating it automatically several times, but with no records. If the jam does not clear by rotating the turntable in a reverse direction, inspect the under side of the changer panel for damaged or missing parts. Inspect the meshing of the drive gear (item 1 on fig. 55) with the pinion gear (item 11 on fig. 55). If the two gears do not mesh, that is, if they are not so timed as to fit together properly, it is probably due to the fact that the clutch engagement lever (item 41 on fig. 49) has been damaged or bent. This clutch engagement lever is intended to contact one of the *lower projections* on the pinion gear (item 11 on fig. 55) so that the teeth of this pinion gear and the teeth of the main drive gear (item 1 on fig. 55) be timed to fit together properly whenever the mechanism starts a change cycle. If the clutch engagement lever (item 41 on fig. 49) is bent, it may be straightened until, by trial, the two gears mesh properly when the changer is tripped. It is advisable that the changer mechanism be operated by hand so that this timing or meshing between the two gears can be more closely observed during any adjustments or inspections.

k. Failure of the simulated gun sound to be audible may be due to a broken voice coil in the speaker. Extreme distortion or poor reproduction may be the result of a broken speaker cone. In the event that either of these difficulties occurs, remove the speaker from the sound cabinet (fig. 27). To do this, remove the top and end of the cabinet which are held in place by wood screws. Next, release the four supporting bolts which hold the unit in place. The cone housing, cone, and voice coil are held in place by four screws. Remove these and make the replacement. Use care in making the electrical connections to be sure the two leads are securely soldered to the contacts of the new cone. Place the wires on the same relative

ANTI-AIRCRAFT MACHINE GUN TRAINER M9



ITEM NO.	DESCRIPTION
1	DRIVE GEAR ASSEMBLY
2	FIBER THRUST WASHER
3	CAM DRIVE LINK ASSEMBLY *
4	CAM DRIVE LINK STUD *
5	ROLLER
6	ROLLER LEVER ASSEMBLY
7	1/8" SNAP WASHER
8	3/16" SNAP WASHER
9	ROLLER LEVER & 12" SET ARM SPR.
10	12" RESET ARM ASSEMBLY
11	PINION GEAR *
12	STOP LEVER SPRING *
13	THRUST PLATE *
14	PANEL MOUNTING STUD
15	SELECTOR SHAFT ASSEMBLY
16	DRIVE CRANK ASSEMBLY
17	DRIVE LINK ASSEMBLY
18	SPINDLE HOUSING & BUSHING ASSEM.
19	DRIVE GEAR SHAFT

(*) SEE FIG. 54 FOR DETAIL ASSEM.

RA PD 80313

Figure 55 — Changer Mechanism — Under Side View

TROUBLE SHOOTING

contacts as the ones from which they were removed. Replace speaker and cabinet panels by reversing the operations previously followed for removing the speaker.

l. The appearance of a distorted or double tone effect in the simulated muzzle blast will probably be due to operating the gun sound without the recoil effect. Under normal operations, the recoil will be utilized, both with and without the explosion sound. If the recoil is cut off, and the gun sound operated, a disturbance will be produced in the electrical circuit, which causes considerable distortion in the sound produced. This disturbance will disappear on turning the recoil switch to "ON."

m. Poor volume of gun sound may be the result of poor adjustment of the gun sound cam on the timer (fig. 25). To correct this difficulty, loosen the two set screws that hold the right rear gun sound breaker assembly in position on the gun sound cam. These set screws are shown on figure 24. With the set screws loosened, rotate the breaker backward and forward slightly, while the gun is being fired, to determine the position in which the desired volume of gun sound is obtained. While holding the breaker assembly in that position, tighten the set screws. In order to make the adjustment on the breaker assembly, it will, of course, be necessary to remove the screws which hold the control panel in place (fig. 3). With the screws removed, slide the panel forward, being careful not to drop it. The timer unit, which is mounted on the base of the control panel, will be carried out of the cabinet as the panel moves forward (fig. 21).

CAUTION: Before attempting to remove the timer unit, disconnect the mechanism from the power source.

26. GUN.

a. If difficulty is encountered in loading the magazine due to the pellets jamming, the cause is likely to be a broken pellet or dirt (fig. 18). If the pellets have not been jammed in too tightly, they will probably drop out if the muzzle of the gun is depressed. If depressing the muzzle fails to release the pellet causing the difficulty, it will be necessary to disconnect the magazine tube and push the pellets out of the loading end with a rod. To do this, open the cover over the gun mechanism (fig. 31) and remove the ball feed block from the piston block (fig. 35). This block is held in position by four screws. With the block released, it may be lifted up to clear the connecting insert, and then moved toward the back of the gun, to pull it away from the magazine tube. With the block removed, it should be possible to push out any pellets causing difficulty. In reassembling the magazine block to the piston block, be sure that the magazine block is pulled down uniformly with each screw, so as to be reasonably airtight.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

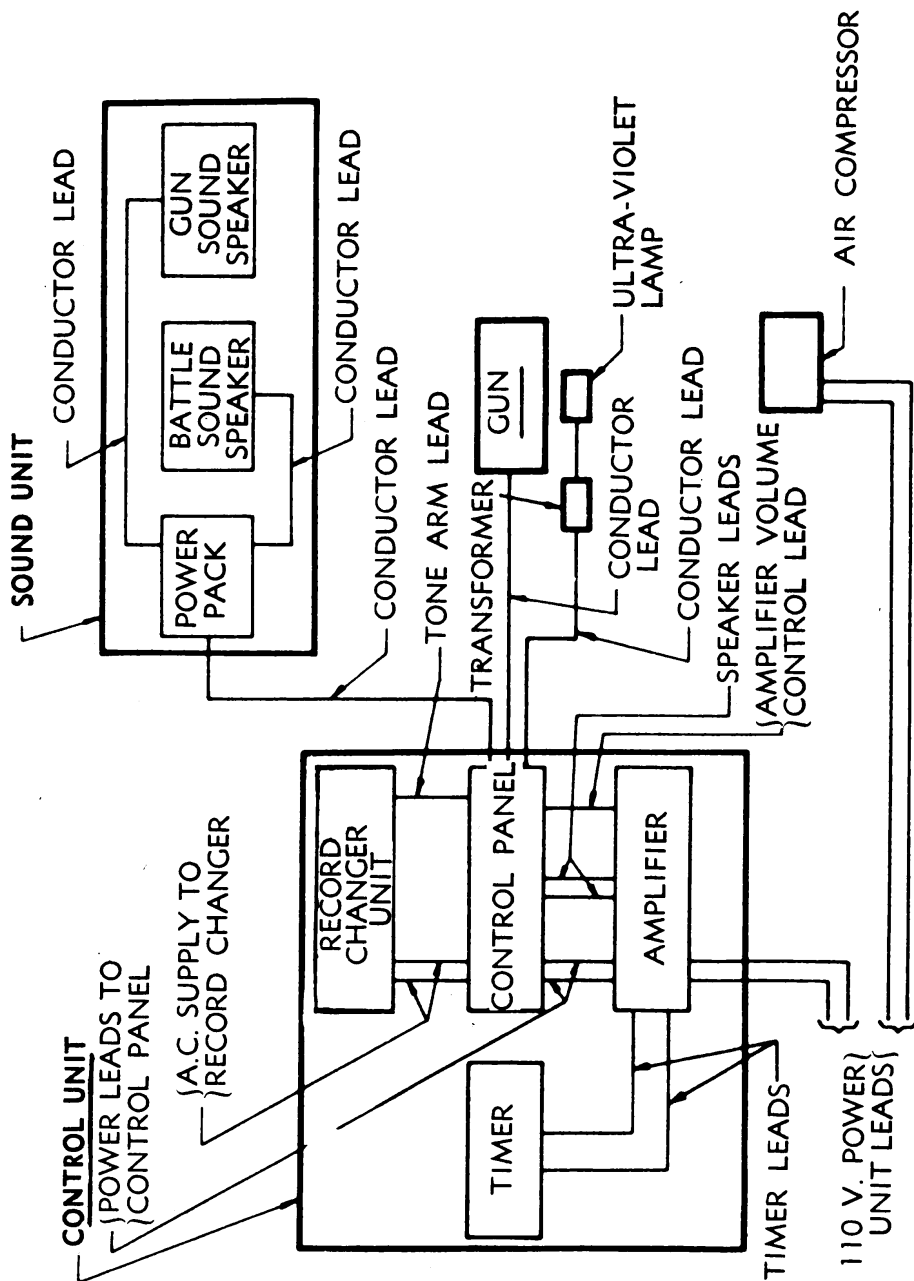


Figure 56 — Trainer — Schematic Wiring Diagram

RA PD 80314

TROUBLE SHOOTING

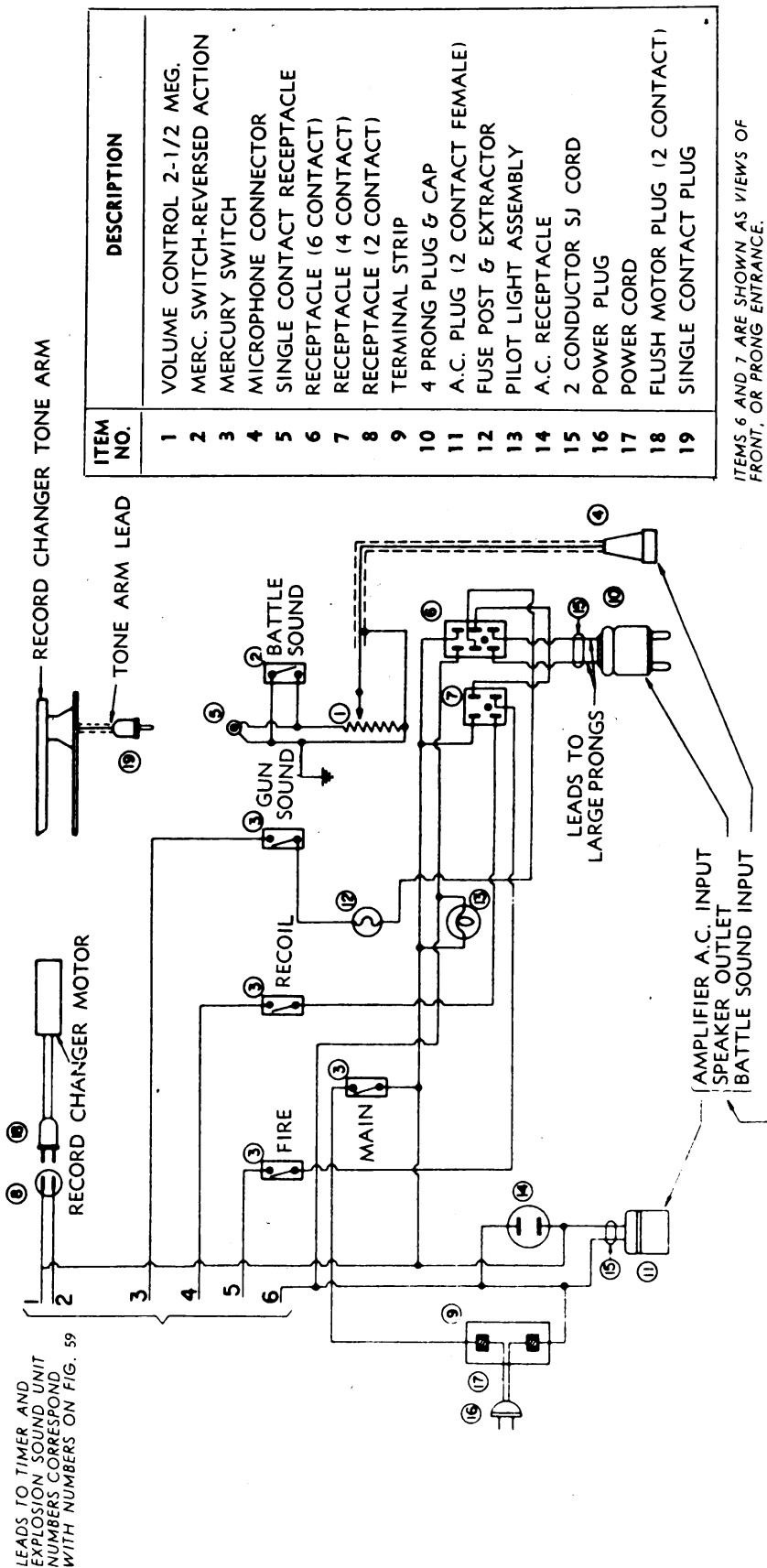


Figure 57 — Control Unit — Wiring Diagram

RA PD 80315

ANTI-AIRCRAFT MACHINE GUN TRAINER M9

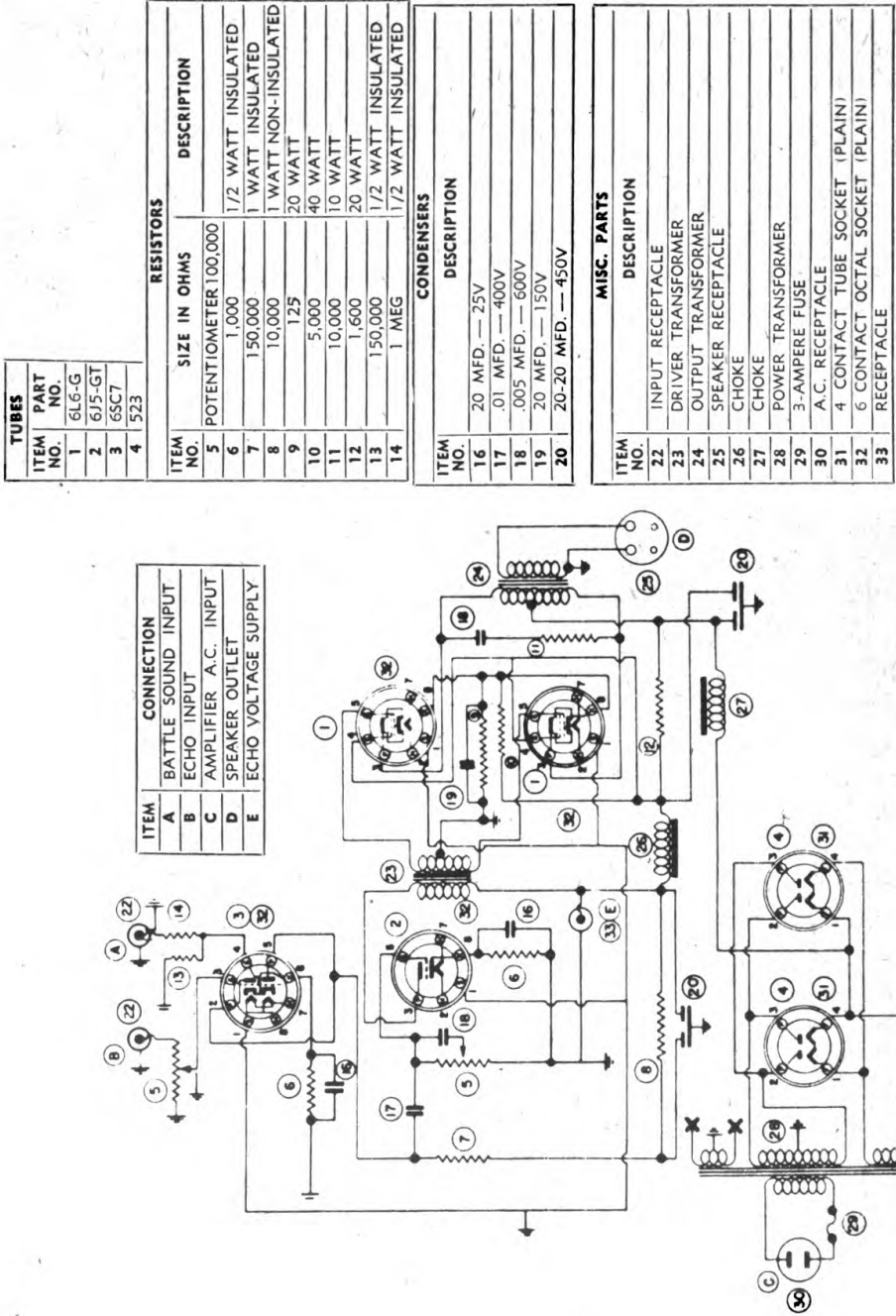


Figure 58 — Amplifier Unit — Wiring Diagram

RA PD 80316

TROUBLE SHOOTING

b. Broken pellets, or dirt mixed with the pellets, may also cause them to jam in the barrel. Sometimes it is possible to blow such a pellet out by increasing the air pressure on the gun from 20 pounds to 50 or 60 pounds. If this does not remove the obstruction, it will be necessary to remove the ball feedblock as described in subparagraph a above. With the block removed, press out the obstructing pellet. It may be possible to work from the top, down and forward, using a light flexible wire. In some cases, it may be necessary to rod out the barrel through the muzzle. To facilitate removal of the released pellet, under these conditions it may be necessary to lift the gun from the tripod and invert it.

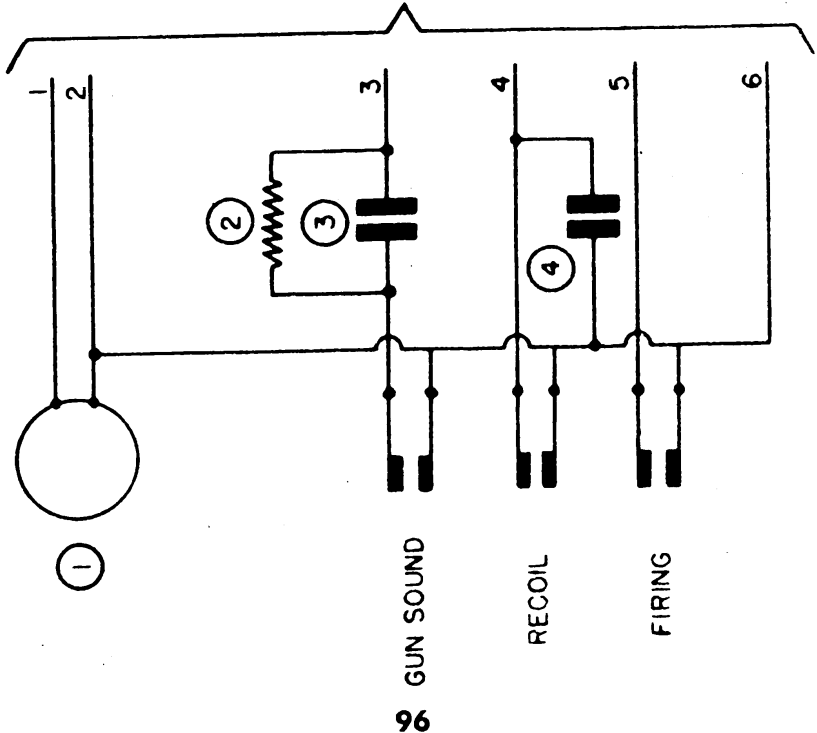
c. If pellets fail to discharge from the gun when the trigger is depressed, the difficulty may be due to lack of air, low voltage, or a pellet being stuck in the barrel. Immediately check the compressor and the valve on the air hose, to be sure that air is available. The discharge of air can usually be heard when the trigger is depressed.

d. If low voltage is the cause of the failure of pellets to be discharged, it may be noticeable by the sluggish movement of the electromagnets. If a check has been made to be sure that air is available and it is unlikely that a ball is stuck in the barrel, the voltage should be checked with the meter to be sure that it exceeds 103 volts. The gun will operate on 115 volts plus or minus 10 percent.

e. The gun is not designed to fire short bursts. If the trigger is depressed or released in such a manner that the electrical circuit is broken in the middle of a firing cycle, the pellet that should have been fired on the last cycle may not be discharged from the barrel. The next time the trigger is depressed, a second ball may be injected into the barrel for discharge by the air stream. This will cause two balls to be fired initially the next time the gun is fired. The results will be that at least one of the balls will fall short of the target. While this will occur occasionally, under normal operation of the gun it will not be noticeable in view of the large number of times the gun will fire correctly, unless attempts are made to use the gun for firing short bursts, in which case the operator will more frequently stop the gun in the middle of a cycle. Discharging of two pellets in this manner is not considered a defect in the device. The unit was not designed to avoid this occurrence.

f. As previously explained, when two pellets are fired simultaneously, the air pressure is not sufficient to carry both pellets to the target in the normal manner. One pellet will fall perceptibly short of the target; the other will fall in the vicinity of the target, but will give the appearance of a wild shot. Such wild shots are due to this abnormal condition and are not due to a defect in the mechanism. The gun will normally discharge pellets accurately enough to place 75 percent of them in a 6-inch circle on a 50-foot range, which is

ANTIAIRCRAFT MACHINE GUN TRAINER M9



ITEM NO.	DISCRIPTION
1	SYNCHRONOUS MOTOR
2	RESISTOR 50,000 OHMS-1 WATT-INSULATED
3	CONDENSER 12 MFD. 600 V.
4	CONDENSER 5 MFD. 600 V.

LEADS TO CONTROL UNIT
NUMBERS CORRESPOND WITH NUMBERS
ON FIG. 57

RA PD 80317

Figure 59 — Timer and Explosion Sound Unit — Wiring Diagram

ANTIAIRCRAFT MACHINE GUN TRAINER M9

ITEM NO.	PART DESCRIPTION
1	TRIGGER SWITCH
2	FIRING ELECTRO-MAGNET
3	RECOIL ELECTRO-MAGNET
4	4-CONDUCTOR CORD
5	4-POLE PLUG

RA PD 80319

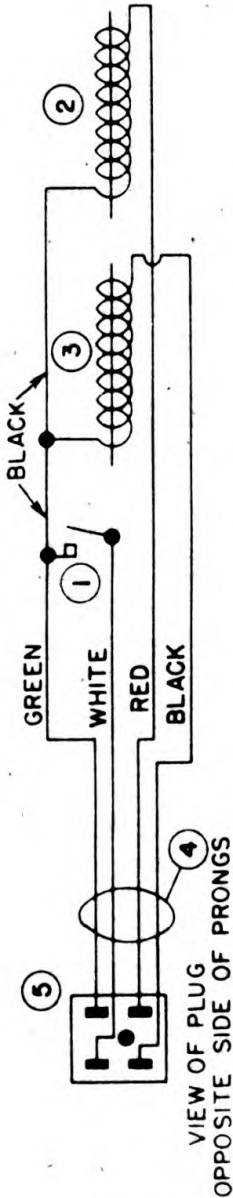


Figure 61 — Gun — Wiring Diagram

TROUBLE SHOOTING

equivalent to the accuracy of the cal. .50 machine gun. While the other 25 percent of the pellets will fall reasonably close to the 6-inch area, occasionally one will be somewhat wilder than the others, possibly due to some inaccuracy in the ball or the introduction of some dirt into the system.

g. If the recoil effect is not adequate, a drop of oil on each side of the electromagnet frame where the plunger slides may be needed. If this does not improve the recoil sufficiently, it is probably due to poor adjustment of the breaker assembly and the timer (figs. 22 and 24). To correct this, first make sure that the circuit breaker points have the correct gap of 0.025 inch. If this does not correct the condition, loosen the set screws on the left rear bracket assembly on the timer (fig. 22). With the gun in operation, rotate the breaker assembly slightly forward and backward to determine the position in which the desired recoil effect is produced. While holding the breaker assembly in this position, tighten the set screws to lock the assembly in place. In order to make the adjustment on the breaker assembly, it will be necessary to remove the screws that hold the control panel in place (fig. 3) and slide the panel out of the cabinet. The timer unit is attached to the base of the control panel (fig. 21). In order to make the adjustment on the breaker assembly, the dust cap, which is held on by a clip, must be removed (fig. 23).

CAUTION: Before attempting to remove the control panel, disconnect the unit from the power source.

h. Excessive arcing of the timer contacts is due to their breaking the circuit at some point other than the zero point of the alternating-current curve. When the recoil and gun sound breaker assembly are adjusted to give the maximum effect, they will ordinarily be in position to produce the least arcing. The right front breaker assembly, which controls pellet shooting, should be adjusted to a position of minimum arcing, by rotating the breaker assembly with the set screws loosened, as explained in subparagraph g above for adjusting the recoil effect.

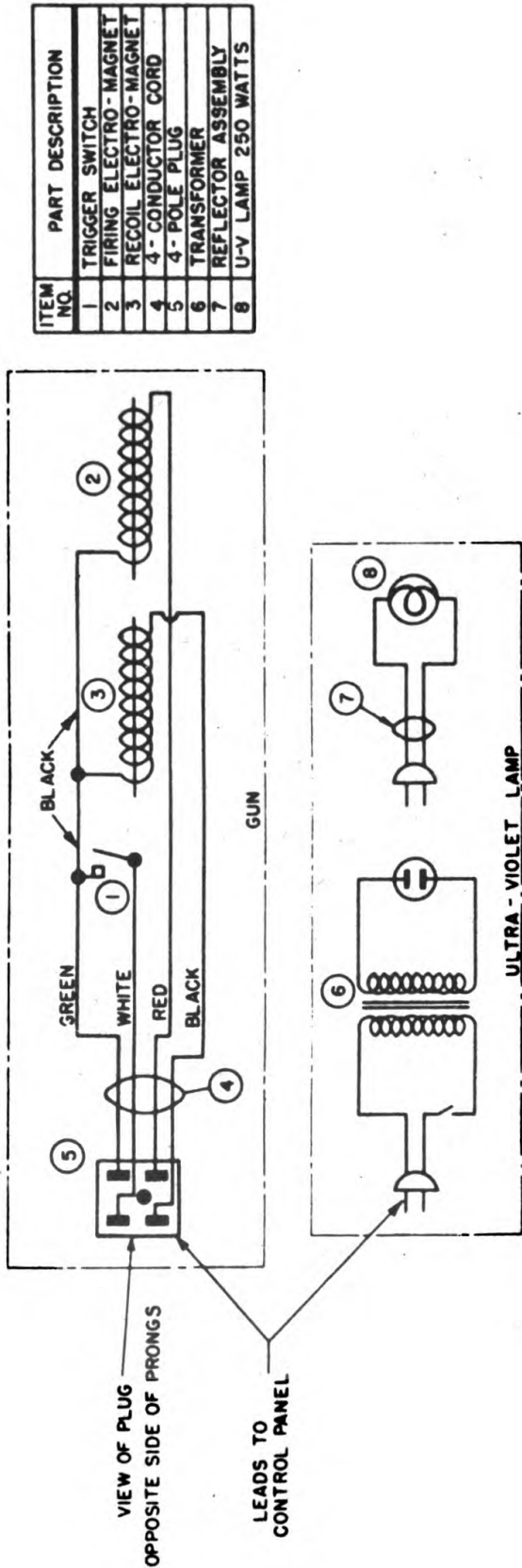
i. In the event that the gun misses fire, the difficulty may be due to poor contact surfaces on the trigger switch (fig. 33). In this event, disconnect the electrical lead from the power source and clean the contacts with a fine file.

CAUTION: Do not use sandpaper to clean the contacts as this may tend to increase the difficulty, due to grit becoming imbedded in the contact surface.

27. AIR COMPRESSOR.

a. If the compressor motor does not come up to full speed, or when it approaches the cut-off point it cuts on and off continuously, the trouble is most likely due to low voltage. The voltage should be checked with a meter and suitable corrections made. The motor on

ANTI-AIRCRAFT MACHINE GUN TRAINER M9



ITEM NO.	PART DESCRIPTION
1	TRIGGER SWITCH
2	FIRING ELECTRO-MAGNET
3	RECOIL ELECTRO-MAGNET
4	4-CONDUCTOR CORD
5	4-POLE PLUG
6	TRANSFORMER
7	REFLECTOR ASSEMBLY
8	U-V LAMP 250 WATTS

RA PD 80320

Figure 62 — Gun, Including Ultraviolet Lamp — Wiring Diagram

TROUBLE SHOOTING

the compressor may run through unusually long intervals if the belt has become loose. This is because the belt will slip and not drive the compressor at the proper speed. To correct this, loosen the bolts and slide the motor back in order to tighten the belt (fig. 38). When the belt tension is adjusted, be sure to realine the pulleys.

b. If the compressor tends to overheat, it may be due to the flywheel operating in the wrong direction. The cooling fan, incorporated as a part of the flywheel, should run in the direction indicated by the arrow on the flywheel for best results. Overheating is also sometimes caused by installing the compressor flywheel too close to a wall, which prevents good circulation.

c. Any tendency for the gun to discharge moisture along with the pellets is due to failure to drain the compressor pressure tank of accumulated moisture. Much of the moisture in the air at the time it is compressed, will be condensed in the pressure tank. Under ordinary circumstances, the tank should be drained once a day through the drain valve (fig. 14).

28. TARGET.

a. Failure of the target to function will most likely be due to mechanical difficulties. The remedy will be obvious. It is advisable to keep the towline taut at all times to avoid tangling.

29. ULTRAVIOLET LAMP.

a. Failure of the ultraviolet lamp to start may be due to the temperature of the lamp. When the lamp is cold, the arc will be struck immediately when the current is turned on; if the lamp is warm at the time the current is turned on, the arc will not occur until the lamp has cooled sufficiently. This takes several minutes and thus may give the impression that the lamp is defective. As this is a normal condition, no correction is necessary under these circumstances.

b. If the pellets are not visible when fired in the dark with the ultraviolet light in operation, the cause may be due to failure to change from the white pellets, used for daytime, to the red fluorescent pellets for use with the ultraviolet light. The red pellets have a fluorescent dye incorporated in them which responds to the ultraviolet light. This is not true of the white pellets.

c. The pellets may not be visible when fired at night due to poor focus of the lamp. To focus the lamp, the gun should be adjusted to hit the unidentified fluorescent plane held stationary in the field of fire. With the gun in the hitting position, the cradle should be locked and the ultraviolet lamp adjusted so that the beam of light is centered on the plane. With such an adjustment of the light, the red pellets will be visible in the vicinity of the target.

CAUTION: Visibility of the red pellets in the ultraviolet light is diminished by interference with house lights, even at considerable distance.

ANTIAIRCRAFT MACHINE GUN TRAINER M9

Section IX

REFERENCES

	Paragraph
Standard nomenclature lists	30
Explanatory publications	31

30. STANDARD NOMENCLATURE LISTS.

a. Cleaning, Preserving, Welding, etc.

Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellaneous re- lated items	SNL K-1
Soldering, brazing and welding material, gases and related items	SNL K-2
Trainer, machine gun, A.A., M9	SNL A-56

Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"..... OPSI

31. EXPLANATORY PUBLICATIONS.

Chemical decontamination materials and equip- ment	TM 3-220
Cleaning, preserving, lubricating, and welding ma- terials and similar items issued by the Ordnance Department	TM 9-850
Defense against chemical attack	FM 21-40

INDEX

A	Page No.	I	Page No.
Adjustments		Identification of machine gun	
air compressor	72	trainer	3
gun	72	Installation of machine gun trainer	
sound unit	68-72	indoor	4-18
targets	73	outdoor	18-23
ultraviolet light	73	Instruction for operation of	
Air compressor		trainer	32-33
adjustment	72		
cleaning	79	L	
description	58	Lubrication of machine gun	
lubrication	74-78	trainer	74-78
removal	7		
trouble shooting	84-85, 99-101	N	
		Night operation of machine gun	
C		trainer	15-18
Care and preservation			
cautions	80	O	
cleaning	78-79	Operation	
handling and storage.....	79-80	final instructions	32-33
lubrication	74-78	trial	28-32
D		P	
Description (of major components)		Precautions in changing air	
air compressor	58	pressure	28
control and sound equipment..	34-45		
gun	46-58	S	
machine gun trainer.....	3	Sound equipment	
targets	62-66	adjustment	68-72
ultraviolet lamp	66-67	cleaning	78
Dimensions of shipping crates.....	4	description	34-35
		lubrication	74
F		trouble shooting	82-83
Function of machine gun trainer....	3		
		T	
G		Targets	
Gun		adjustments	73
cleaning	78-79	cleaning	79
description	46-58	description	62-66
lubrication	74	lubrication	78
trouble shooting	84, 91-99	trouble shooting	85

ANTIAIRCRAFT MACHINE GUN TRAINER M9

INDEX

T—Cont'd	Page No.		Page No.
Trainer, machine gun, A.A., M9		sound equipment	85-91
description	3	target	101
operation	28-33	ultraviolet lamp	101
Trial fire operation.....	28-32		
Tripod pedestal, removal.....	7		
Trouble shooting			
air compressor	99-101		
gun	91-99		
remedial measures	82-85		

U

Ultraviolet light	
adjustments	73
cleaning	79
description	66-67
trouble shooting	85, 101

[A.G. 300.7 (30 Jan 1943)
O.O. 461/42387 O.O. (19 Jun 1943)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
*Major General,
The Adjutant General.*

DISTRIBUTION: R 9(4); IR 4(3); IBn 9 and 44(3); IC 9(3)

(For explanation of symbols, see FM 21-6.)

